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ABSTRACT

This collection focusing on Issues of Education at Community Colleges presents eleven essays by fellows in the mid-career fellowship program at Princeton University: (1) "Teaching the Methodology of Science: The Utilization of Microbial Model Systems for Biometric Analyses" by Joseph A. Adamo; (2) "Two Modes of Mathematics Instruction" by Simon I. Aloff; (3) "Writing-Across-the-Curriculum at Union County College" by Marjorie Barnes; (4) "Non-Traditional Teaching Styles in Physics" by Bruce R. Boller; (5) "Cheating and its Vicissitudes" by Mark L. Cozin; (6) "Instructional Technology and Faculty Development" by Carole A. Holden; (7) "Use of the Internet in Teaching Mathematics in the Community College" by Charles J. Miller, Jr.; (8) "Cooperative Learning in the Community College Biology Classroom" by Doris C. Morgan; (9) "Non-Traditional Instruction" by Jeannette I. O'Rourke; (10) "Caring, Community, and Transcendence: Developing the Spirit To Improve Learning" by Myrna J. Smith; (11) "Action Methods for Teaching Cultural Diversity Awareness" by Daniel J. Tomasulo. (VWC)

Princeton University
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1998 - 1999

ISSUES OF EDUCATION AT COMMUNITY COLLEGES

ESSAYS BY FELLOWS

IN THE

MID-CAREER FELLOWSHIP PROGRAM

AT PRINCETON UNIVERSITY

JULY 1999

Table of Contents

Joseph A. Adamo Ocean County College	"Teaching the Methodology of Science: The Utilization of Microbial Model Systems for Biometric Analyses"
Simon I. Aloff Middlesex County College	"Two Modes of Mathematics Instruction"
Marjorie Barnes Union County College	"Writing-Across-the-Curriculum at Union County College"
Bruce R. Boller Bergen Community College	"Non-Traditional Teaching Styles in Physics"
Mark L. Cozin Raritan Valley Community College	"Cheating and its Vicissitudes"
Carole A. Holden County College of Morris	"Instructional Technology and Faculty Development"
Charles J. Miller, Jr. Camden County College	"Use of the Internet in Teaching Mathematics in the Community College"
Doris C. Morgan Middlesex County College	"Cooperative Learning in the Community College Biology Classroom"
Jeannette I. O'Rourke Middlesex County College	"Non-Traditional Instruction"
Myrna J. Smith Raritan Valley Community College	"Caring, Community, and Transcendence: Developing the Spirit to Improve Learning"
Daniel J. Tomasulo Brookdale Community College	"Action Methods for Teaching Cultural Diversity Awareness"

TEACHING THE METHODOLOGY OF SCIENCE: THE UTILIZATION OF MICROBIAL MODEL SYSTEMS FOR BIOMETRIC ANALYSES

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ABSTRACT

More often than not introductory science courses end up being courses about science and not a study of science and the way it works in the real world. The approach of "covering" the material for students required to take standardized tests usually requires the instructor to relinquish his or her academic freedom and creativity in order to teach to the test. Science is a process, a methodology, an intelligent way of solving problems. The Scientific Method is the beginning and the end, the α and the Ω of the discipline. Getting an undergraduate student to think quantitatively, analytically and from a scientific point of view is often a challenge and a major objective of the instructor of microbiology. The utilization of models and model systems in scientific research is often the genius of the work and a major way research unfolds in the laboratory. The use of models in research and science education is briefly discussed. We attempt to create an environment that will allow the student to experience science. Student response and reaction to the experience are included in the study.

The present study was conducted to develop scenarios and microbial model systems that would allow the student to apply bio-statistical analyses to their work. Calibrated microscopes were used to measure the lengths and widths of replicated samples of various species of bacteria. The lengths and widths were also measured of numerous samples of *Rhabditis*, a common, essentially microscopic, soil nematode and *Turbatrix aceti*, a nematode of historical significance. These data were used to compute means, modes, medians, ranges, variances, standard deviations and to establish frequency distributions and correlation coefficients. Frequency distributions were further employed to detect contaminants in pure cultures which were later verified by gram-staining. Microscopic data were also utilized to test hypotheses by way of t-tests. Various strains of *Escherichia coli*, were screened for antibiotic resistance using phenol red dextrose broth (PRDB). Selected bacteria and antibiotic combinations were used in a replicated dosage-growth study utilizing spectrophotometric measurements. These data were then subjected to analyses of variance (ANOVA) and multiple comparison tests. Students set in their ways are usually reluctant, as a general rule, to deal with open-ended investigative scenarios. In order to acquaint the student with the physical Method and philosophical thought process of the discipline the tone of the course must be set early on. The use of biometric analyses introduced the student to the reality of scientific thought, allowing the novice student to appreciate scientific methodology on a whole new quantitative level.

INTRODUCTION

Science education at the college introductory level has too often become one of traditional lecture with some laboratory work. That the laboratory hands-on aspect has been maintained is certainly fortunate, since the engine that drives the discipline of science is the Scientific Method. The methodology of science, the process, clearly requires experimental activity. Too often introductory courses teach about science not science itself and the instructor becomes primarily a disseminator of information, rather than a teacher of the thinking, creative process of science.

<u>The Scientific Method</u>:
Modern science is defined by the Scientific Method. The method is the beginning and the end, the limits of the discipline. The process is essentially an intelligent way of solving problems. Formally, the steps of the process include: making observations, posing problems, speculating hypotheses, designing experiments to test the speculations, collecting and analyzing data, and developing theories based upon well established validated hypotheses. The aim of science is to make and use theories. A theory is considered to be a temporary truth, a well established concept subject to modification as new data becomes available. Science is a work in progress. Science is a process, a methodology.

<u>Modern Biology a Visual and Quantitative Study</u>:
The study of modern biology is one of visualization and quantification. Biology like other sciences began with observations, primarily visual. The 14th-17th century Renaissance in Europe initiated a great deal of scientific experimentation, the development of the microscope and the birth of microbiology. Actually, the development of the field of microbiology had a great deal to do with experimental testing of Aristotle's concept of *Spontaneous Generation* which had a tremendous impact on the work of Louis Pasture, who is known as the "Father of Modern Experimental Microbiology". Max Dulbruck in 1941 established a quantitative phage course at Cold Spring Harbor Laboratory (Long Island, New York) for a group of researchers destined to establish the field we currently refer to as Molecular Biology and which led the young James Watson to collaborate with Francis Crick to divine the three dimensional structure of the DNA molecule. Max Dulbruck has been called the "Father of Molecular Biology". The "cutting edge", or as some would say the "bleeding edge" of modern biology is one of isolating and determining the way various molecules exist in space, i.e. visualization. The form of the molecule then is related to the way it works, the physiology (What is the molecular structure of the AIDs virus and how does it link up to the T cell?). All studies of this type seek visualization of one sort or another and require a tremendous amount of quantitative analyses.

Model Systems:
Various biological model systems are utilized to perform experimental work that allow the modern biologist to collect quantitative data and to visualize. Each model system is ideal for a particular type of study. For example *Drosophila melanogaster*, the fruit fly, having easily identifiable virgins, numerous detectable phenotype characteristics, generating large numbers of offspring in a short period of time, and its ease of breeding make these forms of life ideal for genetic studies. Some other major experimental biological model systems include: *Escherichia coli* (*E. coli*), probably the best known organism of all the 5×10^6 plus known creatures, its DNA also having been completely sequenced; *Saccharomyces cerevisiae* (brewer's yeast), the first eukaryote to have its DNA completely sequenced; *Neurospora crassa* (pink bread mold), involved in the development of new experimental approaches and the relationship between the protein molecule and the gene; *Caenorhabditis elegans*, a common nematode, the only multicellular organism to have its DNA completely sequenced and to have its entire embryology and development completely worked out from conception to death of the adult; and of course *Mus musculus*, the white mouse probably the most used model in the medical field. There are a number of significant models among the viral group including: Vaccinia virus, Tobacco Mosaic Virus (TMV), T_2, λ ,ΦX-174, and the influenza virus. Inanimate objects such as soap bubbles and lead shoot have also been used as model systems for the experimental study of cellular area, volume, structure and various other aspects of cellular biology.

In earlier work the author has created and utilized many model systems, both live and non-living, to visualize and/or to quantify biological concepts for research and teaching activities (Adamo et al., 1993; Adamo and Gealt, 1996a). The distributions generated by the rolling of a pair of dice were used to study the Normal Distribution (Adamo, 1963). Catsup, a very complex (non-Newtonian) fluid, was utilized to explore the chemistry and physiology of the movement of the *Amoeba* (Adamo, 1964). Salt crystals, beads and toothpicks allowed students to determine three dimensional measurements using two dimensional "micrographs", a common electron microscope technique (Adamo and Kalichstein, 1969). Three-ply string, glass slides, match sticks and rice petioles served to study the migration of pathogenic microscopic nematodes (Adamo et al., 1976a, 1976b). An actual model of an icosahedron was constructed to familiarize the student with the visual, quantitative and structural aspects of a basic virus particle (Adamo, 1993). The icosahedral ΦX–174 and the complex T_2 bacteriophages served as models for the development of a metabolic inhibition test (Adamo, 1996). We have used nematodes to model the natural transfer of DNA in the environment (Adamo and Gealt, 1998; 1996a) and as agents of disease transfer (Adamo and Gealt, 1996b). A simple eyedropper has even been utilized to model serial sections and the derivation of complex three dimensional structure from a series of two dimensional views (Kalichstein et al., 1973).

The Current Study:

The present study was conducted to develop scenarios and microbial model systems that would allow the student to apply bio-statistical analyses to their visual and quantitative work. To shock, if need be, the student into experiencing the reality of the philosophy and methodology of the science of biology.

MATERIALS AND METHODS

Student Population:

The following studies were not all completed utilizing a single group of students. The report is a summary of experimental designs, data collected and analyses performed by four distinctly different groups in terms of space and time. Some of the work was completed by all four groups, while other portions were accomplished by one or two of the groups.

Calibration of the Microscope:

Each student calibrated an ocular micrometer in the usual manner, i.e. a particular eyepiece micrometer was compared to a stage micrometer, having known "grid" space values. The value of each ocular space was determined using a 4 X, 10 X, 40 X and 100 X objective. The student then created a table showing ocular space values for their particular scope, objectives and ocular for future use.

Measurements of Bacteria:

The students prepared bacterial smears of *Escherichia coli* using aseptic technique, allowing the smears to air dry and fixing using a Bunsen burner flame. The smears were then stained using methylene blue. Each student than created a data sheet and proceeded to measure the length and width of 25 *E. coli* cells using the micrometer. Other species of bacteria were measured using the same techniques.

Following data collection, each student: (a) calculated the average length and width of an *E. coli* cell; (b) determined the mode, median, range, variance and standard deviation for each set of data; (c) prepared a frequency distribution for the length and width data; (d) computed a correlation coefficient and (e) estimated the volume of one *E. coli* cell.

Using Frequency Distribution to Detect Contaminants:

Frequency distributions were utilized to detect a contaminant in a pure culture. Pure cultures, those containing only one species of organism, are required for experimental work. For this study cultures of *E. coli* and *Bacillus megatherium* were concentrated, mixed and supplied to the students. The students were not aware the culture was mixed, they assumed they had a pure culture. Bacteria were concentrated using 1 mL samples in microfuge tubes and centrifuged at 14,000 rpm for 3 mins. Students were instructed to prepare two bacterial smears the first of which was to be simple stained. The second slide was stored for future use, to be gram stained after the analysis of the length of 50 bacteria was completed. The students were instructed to use the stained slide to measure the length of 50 bacteria, to store the second slide and to construct a frequency distribution. *B. megatherium* is about 3-6 µm in length and gram positive while *E. coli* is about 1- 2.5 µm and gram negative. Random measurements result in a bimodal distribution indicating two species. After analyses the students were instructed to run a gram stain on the second slide. The results here clearly indicate a mixed culture, i.e. two species, should the bimodal curve elude student interpretation.

Measurements of Nematodes:

Two different sources of nematodes were utilized in the development of these techniques. The first was *Turbatrix aceti*, of historical significance (van Leeuwenhoek's "vinegar eels"). These were cultured in a simple apple and cider vinegar medium. The second were cultures of *Rhabditis*, isolated from campus soil and propagated on spread plates of pure cultures of *E. coli*. In the case of the spread plate cultures, students used sterile nutrient broth to flood a small area of a 6-7 day old petri plate freeing into fluid many active worms. In either case a drop of culture containing active nematodes was placed on a clean microscope slide. The slide was then placed on a hot plate (set very low) for a very short period of time. Enough heat was used to end active movement but not so much as to evaporate the fluid or cook the worms. Nematode activity can be viewed very conveniently using a dissecting low power scope. The heat treatment "heat-relaxes" the nematodes. This treatment relaxes the muscles of the worm causing them to straighten out for length measurement. Again each student created a data sheet and proceeded to collect measurements. Each student measured the length and width of 25 adult nematodes. A sample mean, mode, median, range, variance, standard deviation and frequency distribution were calculated for each set of data. A correlation coefficient was then computed (length vs. width).

Hypothesis Testing Comparing Two Means Utilizing t-Testing:

Using the nematode data collected earlier of *T. aceti* lengths paired students were asked to compare their means. The paired t-test was utilized testing the hypothesis that the means were equal.

Screening Bacteria for Antibiotic Sensitivity :

Students screened various strains of *E. coli* for antibiotic resistance using a number of different antibiotics and phenol red dextrose broth (PRDB). The PRDB medium was used for a metabolic inhibition test (Adamo, 1996; Adamo and Gealt, 1998). Those strains found to be resistant were used in a dosage-growth study. The results for *E. coli* χ1997 and nalidixic acid will be reported in this paper. This stain of *E. coli* was found to be resistant to this antibiotic (nalidixic acid). The experiment was replicated three times. Nine tubes of nutrient broth (6 mL each) were prepared and supplemented with antibiotic. Three tubes were supplemented with the recommended dose for this antibiotic (20μg/mL), three with half dose (10μg/mL) and the final three with a double dose (40μg/mL). The supplemented nutrient broth tubes were inoculated with a given amount of bacteria and incubated at 37 C for 18 hours. The cultures were then each mixed and 3 mL of each placed individually in a "Spectronic 20" cuvette. Each sample was then subjected to a spectrophotometric measurement of turbidity for optical density. Mean values were established and all the data was subjected to analysis of variance (ANOVA) and multiple comparison tests.

RESULTS AND DISCUSSION

As a general rule during the development of this work the data collected was subjected to computations of means, modes, medians, ranges, variance, standard deviation, correlation coefficients and frequency distributions. For the sake of brevity the results reported below are reduced and representative of that actually obtained.

Generally, even with science majors, the current population of undergraduate students in general, apparently prefers to attend a brief lecture, take a few (very few) notes, parrot back information on a straightforward no surprise or thought requiring test, meet once a week and have a simple "cookbook" laboratory experience. Will this be on the test? Do we have to know any of this material? Tell me exactly what I should know. Investigative, open ended, challenges are met with very little enthusiasm by most, at first. In general, there seems to be an inert laziness, or an overextended busyness of the student. The student really needs to experience the process in order to determine whether this in fact is the area he or she wishes to pursue. There is a repetitiveness, a "donkey work" activity associated with scientific study. The student needs to experience the redundance of the work which is part of the scientific process.

Calibration:

Each student calibrated his/her own ocular micrometer and developed a table for the ocular space value data. Table 1 shows a typical student developed structure. Creating a table is an exercise in organization and presentation of data, an important part of any investigative work.

Many students find calibrating a microscope the first time to be a very frustrating experience. Measuring a large visual object is easy for the student but do exactly the same thing microscopically and it becomes extremely challenging.

Bacteria:

Each student prepared a number of bacterial smears and measured the length and width of 25 randomly selected samples for each species. The width measurements were done using oil and at the limits of the ocular micrometer utility where one space more or less was used to determine the width. This required significant student judgment and in part accounts for some of the data distribution. A table to organize the data collected was prepared. Table 2 shows a typical set of data collected by a student. Again creating a table is an exercise in organization and presentation, a valuable experience. The actual data collected was compared and peer evaluated an experience in accurate measurement technique and in variation in scientific work. Means, modes, medians and ranges were calculated (Table 3) and compared as were calculations of *E. coli* cell volume. The mean length was found to be 1.72 μm and the mean width to be 0.71μm (from student data shown in Table 2 and 3). Histograms were prepared for the length and width data and are shown in Figures 1 and 2. Using the equation for the volume of a cylinder($V = \pi r^2 h$) the volume of an *E. coli* cell was estimated to be 0.68 μm^3.

Nematodes:

Each student prepared a number of nematode slides and a data sheet to organize the data collected. Table 4 shows a typical set of data collected by a student. The data were compared and peer evaluated. Table 3 shows the results of the various student computed length and width central tendency statistics. Tables 4 and 5 show the *Rhabditis* length and width correlation computation data, the sums and the calculation of "r". The correlation was determined to be $r = 0.81$. Some students got values for "r" as high as 0.92, a very high, positive correlation.

Hypothesis Testing Comparing Two Means Utilizing t-Testing:

Using the nematode data collected earlier of *T. aceti* lengths paired students were asked to compare their means. The paired t-test was utilized testing the hypothesis that the means were equal.

Two student sets of data that had differing means (770.92 vs. 707) were selected for this report as the two students each felt they had the "right" answer and that the other was sloppy, criticizing each other. The data and computations are shown in Table 6. The results of the t-test demonstrated to the two students that their means were statistically the same, giving each some things to consider.

Screening Bacteria for Antibiotic Sensitivity :

The results for *E. coli* χ1997 and nalidixic acid will be reported in this paper. This strain of *E. coli* was found to be resistant to this antibiotic (nalidixic acid). A dosage-growth experiment was replicated three times. Nine tubes of 6 mL nutrient broth were supplemented with antibiotic. Three tubes with the recommended dose for this antibiotic (20µg/mL), three with half dose (10µg/mL) and the final three with a double dose (40µg/mL). The supplemented nutrient broth tubes were inoculated with a given amount of bacteria and incubated at 37 C for 18 hours. The cultures were then each mixed and 3 mL of each placed individually in a "Spectronic 20" cuvette. Each sample was then subjected to a spectrophotometric measurement of turbidity for optical density. Mean optical density values and the results of the ANOVA / multiple comparison test are given in Table 7. These data indicate inhibition of the bacterium as dosage of the antibiotic increased. Although not significant more growth was measured at the half dosage level than at the normal dose. However, there was a significant decrease in growth when the dosage was double that of the normal recommended dose.

Table 1. Shows one student's table of the space values using ocular #17 for the different objectives of microscope #3.

MAGNIFICATION	OBJECTIVE	SPACE VALUE (µm)
40 X	Scan	20.90
100 X	Low	7.14
400 X	High Dry	1.65
1,000 X	Oil	0.73

Table 2. Shows the length and width measurements of *Escherichia coli* cells in smears taken from 24h cultures grown at 37°C.

Sample #	Length (μm)	Width (μm)
1.	1.87	0.68
2.	1.53	0.68
3.	1.36	0.82
4.	1.97	0.75
5.	1.70	0.68
6.	1.56	0.61
7.	1.90	0.75
8.	1.70	0.85
9.	1.53	0.61
10.	1.36	0.75
11.	1.77	0.68
12.	2.04	0.68
13.	1.84	0.68
14.	2.11	0.82
15.	1.70	0.75
16.	1.36	0.68
17.	1.87	0.61
18.	1.63	0.68
19.	1.43	0.68
20.	1.90	0.68
21.	1.36	0.82
22.	1.53	0.75
23.	2.04	0.85
24.	1.90	0.68
25.	1.97	0.61

Table 3. Shows a compilation of *Eschericihia coli* and *Rhabditis* length and width central tendency statistical data.

	E.coli		*Rhabditis*	
Statistic	Length* (μm)	Width* (μm)	Length* (μm)	Width* (μm)
Mean	1.72	0.71	606	26.9
Mode	1.36	0.68	607	28.6
Median	1.70	0.68	607	28.6
Range	0.75	0.24	142	14.3

*n = 25

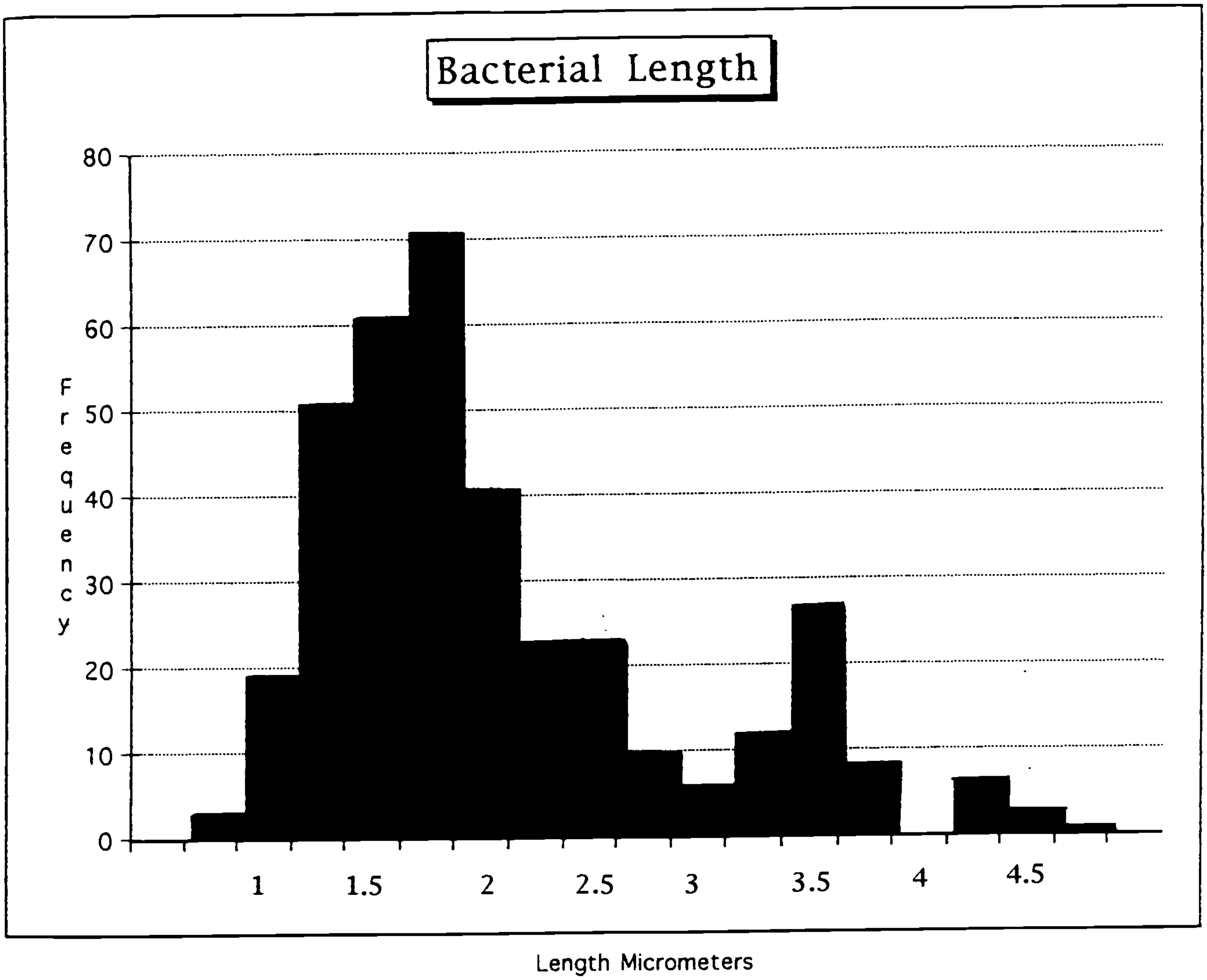

Figure 1. Shows the collective class distribution of *Escherichia coli* length measurements, for the *Frequency Distribution to Detect Contaminants Study.*

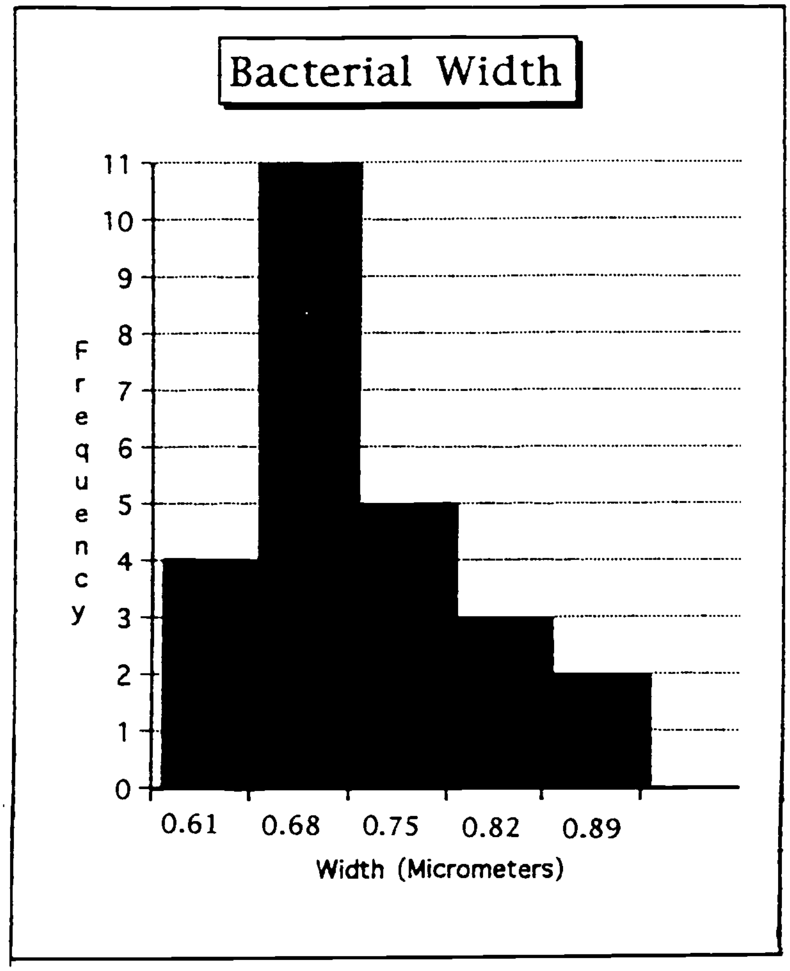

Figure 2. Shows the distribution of *Escherichia coli* width measurements from one student's data (found in Table 2).

Table 4. Shows one student's *Rhabditis* length and width correlation computation data.

	(length) X	(width) Y	X^2	Y^2	XY
1.	650	28.6	422500	817.96	18590.0
2.	536	24.9	287296	620.01	13346.4
3.	564	24.9	318096	620.01	14043.6
4.	607	28.6	368449	817.96	17360.2
5.	607	28.6	368449	817.96	17360.2
6.	628	28.6	394384	817.96	17960.8
7.	571	21.4	326041	457.96	12219.4
8.	600	28.6	360000	817.96	17160.0
9.	557	21.4	310249	457.96	11919.8
10.	593	21.4	351649	457.96	12690.2
11.	607	28.6	368449	817.96	17360.2
12.	571	21.4	326041	457.96	12219.4
13.	643	28.6	413449	817.96	18389.8
14.	678	35.7	459684	1274.49	24204.6
15.	636	28.6	404496	817.96	18189.6
16.	600	28.6	360000	817.96	17160.0
17.	607	28.6	368449	817.96	17360.2
18.	628	28.6	394384	817.96	17960.8
19.	636	28.6	404496	817.96	18189.6
20.	614	28.6	376996	817.96	17560.4
21.	636	28.6	404496	817.96	18189.6
22.	557	21.4	310249	457.96	11919.8
23.	628	28.6	394384	817.96	17960.8
24.	586	21.4	343396	457.96	12540.4
25.	607	28.6	368449	817.96	17360.2

Table 5. Shows the sums of the *Rhabditis* length and width correlation computation data and the calculation of "r".

Totals	
$\Sigma X = 15{,}147$	$\Sigma Y = 671.5$
$\Sigma X^2 = 9{,}204{,}531$	$\Sigma Y^2 = 18{,}349.63$
$\Sigma XY = 409{,}216$	$n = 25$
Calculation of "r"	$r = 0.81$

13

Table 6. Shows two student's length measurements for *Turbatrix aceti* and computations to test the hypothesis that the means are equal.

Sample #	Length Student#1 (µm)	Length Student #2 (µm)
1.	936	711
2.	1289	587
3.	318	569
4.	583	587
5.	600	1280
6.	1112	533
7.	530	711
8.	512	533
9.	794	604
10.	1183	729
11.	812	836
12.	477	445
13.	565	302
14.	547	1067
15.	441	267
16.	530	1600
17.	600	924
18.	494	320
19.	1147	533
20.	1067	676
21.	1600	599
22.	899	899
23.	836	605
24.	836	922
25.	565	836

<u>Student #1</u>

$\Sigma X = 19273$

$n = 25$

$\bar{X} = 770.92$

$\Sigma X^2 = 17272183$

$S^2 = 100593.41$

$S = 317.16$

<u>Student #2</u>

$\Sigma X = 17675$

$n = 25$

$\bar{X} = 707$

$\Sigma X^2 = 14663927$

$S^2 = 90320.92$

$S = 300.53$

<u>t-Test Data:</u>

$H_o: \mu 1 = \mu 2$

$H_i: \mu 1 = \mu 2$

Assume: $(\sigma^2 1 = \sigma^2 2)$ or $(\sigma^2 1 \neq \sigma^2 2)$ DF=48

Then: t=-1.67185468 AR[-2.013 to +2.013]

Therefore: Accept Ho: $\mu_1 = \mu_2$

<u>Both means are the same</u>

This paper will also be presented at the Annual Meeting of the American Society for Microbiology (A S M) to be held in Chicago, Illinois, May 30 - June 3, 1999.

The meeting this year celebrates the 100 th Anniversary of the society.

Table 7. Shows the spectrophotometric growth measurements of *E. coli* χ1997 versus the antibiotic Nalidixic acid.

Nalidixic Acid/*E. coli* χ1997	
Dosage	Optical Density Means[1]
10 µg/mL	0.21a
20 µg/mL	0.19a
40 µg/mL	0.13b

[1]Means of 3 replicates each. Those means followed by the same letter are statistically the same, those by a different letter are significantly different P=0.05.

Future Work:

An experiment should be designed to utilize regression analyses. Using a standard replicated inoculum of *E. coli* in a given volume of a standard liquid medium, replicates could be incubated at several controlled temperatures i.e. 25, 30, 35, 37 and 42 C. After a given time of incubation the sample could be subjected to spectrophotometric analyses to determine growth at the various temperatures. Does the the temperature of incubation effect the growth of the bacteria? This would constitute a typical "cause and effect" regression analyses scenario.

Conclusion:

Here, as in much of my earlier work, I found that students, once willing to accept the challenge, are stimulated and get excited when they settle into the practice of science. When the student is exposed to the way research unfolds in a laboratory or when they replicate a historic experiment they seem to get a sense of belonging to a special group, "coming of age", the beginning of a true understanding of the discipline. Clearly early work of this nature sets the tone of the course and allows the novice student to appreciate the Scientific Method and Science on a whole new level.

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TWO MODES OF MATHEMATICS INSTRUCTION

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In recent years mathematics education has witnessed a dramatic increase in student use of hand-held calculators. Students are being encouraged to use calculators in many areas of mathematics, particularly in graphing. Many faculty have revised their method of class presentation and now give lectures that are calculator dependent. In this new style of presentation the instructor uses a projected image of a calculator on a screen to lead students through solutions to a set of problems. New texts have been published that depend heavily on the use of the calculator. A typical such text begins with a chapter explaining the use of standard calculator. The remainder of the book stresses problems that involve the use of a calculator. The net effect is to leave the student with the false impression that mathematics can't be done without the use of a calculator.

There can be little doubt that calculators make it possible to do difficult calculations quickly and efficiently. When used for this purpose they must be viewed positively since they allow students to move on to the more interesting aspects of a mathematics problem. However, educators should always keep in mind that much of elementary mathematics rests on a set of key ideas that are best illustrated using simple calculations. In fact doing these elementary calculations is often the necessary ingredient for a true understanding of the concept.

In this paper I will present some key "mini-lessons" from arithmetic, algebra, and geometry that I hope will illustrate my point of view. The first three lessons come from basic arithmetic. There is a popular view that arithmetic is only a collection of dull algorithms containing no interesting ideas. However, if we go a little below the surface we will see that there are many fascinating ideas waiting to be discovered.

Lesson 1: Fractions and Factor Trees

Let's consider the technique necessary to add two fractions, say $\frac{1}{6} + \frac{1}{8}$.

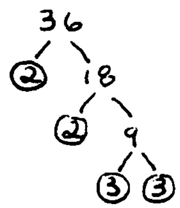
Many students quickly fall into the obvious trap and respond

$\frac{1}{6} + \frac{1}{8} = \frac{2}{14}$ (incorrect)

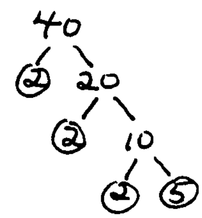
$\frac{2}{14}$ can't be the correct answer because $\frac{2}{14} = \frac{1}{7}$ and $\frac{1}{7}$ is smaller than $\frac{1}{6}$, so the right side would be smaller than the left. With a little coaching the student realizes that the numerators of the fractions can be added only when we have a common denominator. Thus the problem reduces to finding a common denominator for the two fractions, and then expressing them as equivalent fractions using this denominator.

For a common denominator we must find a number that is a common multiple of 6 and 8. Also we want it to be as small as possible so it will be the lowest common denominator. Most students easily see that 24 is the lowest common denominator. Then $\frac{1}{6} = \frac{4}{24}$, $\frac{1}{8} = \frac{3}{24}$, so $\frac{1}{6} + \frac{1}{8} = \frac{4}{24} + \frac{3}{24} = \frac{7}{24}$.

But what if the denominators were large numbers? Would it still be easy to find the lowest common denominator? The answer is yes. We can factor each denominator into a product of primes using factor trees. For example consider $\frac{1}{36} + \frac{1}{40}$. First we factor 36 and 40 using factor trees. Each prime factor is circled in the tree.



$36 = 2 \cdot 2 \cdot 3 \cdot 3$



$40 = 2 \cdot 2 \cdot 2 \cdot 5$

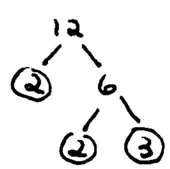
From these factorizations it is clear that the smallest common multiple of 36 and 40 is $2 \cdot 2 \cdot 2 \cdot 3 \cdot 3 \cdot 5 = 360$.

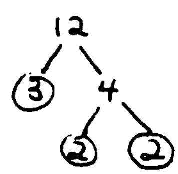
Then $\frac{1}{36} = \frac{1}{36} \cdot \frac{10}{10} = \frac{10}{360}$

$\frac{1}{40} = \frac{1}{40} \cdot \frac{9}{9} = \frac{9}{360}$

and $\frac{1}{36} + \frac{1}{40} = \frac{10}{360} + \frac{9}{360} = \frac{19}{360}$.

The factor tree method leads to the following question. A number can have more than one factor tree associated to it. For example





Will different trees for the same number always lead to the same prime factorization? The answer is yes and is known as The Fundamental Theorem of Arithmetic.

Lesson 2: Repeating Decimals

Consider the problem of finding the decimal expansion for a fraction. This involves the repetitive process of long division, and the natural temptation would be to do all such computations with a calculator. However, when the expansions are infinite in length, the calculator can only give approximations which do not reveal certain interesting patterns.

For example,

$\frac{1}{2} = .5$	$\frac{1}{8} = .125$	$\frac{1}{14} = .0\overline{714285}$
$\frac{1}{3} = .\overline{3}$	$\frac{1}{9} = .\overline{1}$	$\frac{1}{15} = .0\overline{6}$
$\frac{1}{4} = .25$	$\frac{1}{10} = .1$	$\frac{1}{16} = .0625$
$\frac{1}{5} = .2$	$\frac{1}{11} = .\overline{09}$	$\frac{1}{17} = .\overline{0588235294117647}$
$\frac{1}{6} = .1\overline{6}$	$\frac{1}{12} = .08\overline{3}$	($\overline{\ \ }$ indicates repeating digits)
$\frac{1}{7} = .\overline{142857}$	$\frac{1}{13} = .\overline{076923}$	

We immediately notice that each value is either a finite decimal or an infinite repeating decimal. If we look more carefully, we see that finite decimals are obtained when the denominator has factors only of 2 or 5. This should not be so surprising since our number system is based on 10 , and $10 = 2 \times 5$. However, there is still the question of why all the other fractions lead to <u>repeating</u> decimals. Let's use the division algorithm to evaluate a typical case, say $\frac{1}{7}$. We will circle each remainder in the division process starting with the initial numerator of 1. This should make the pattern clearer.

$$\begin{array}{r}
.142857 \\
7\,\overline{)\,1.000000} \\
\underline{7} \\
30 \\
\underline{28} \\
20 \\
\underline{14} \\
60 \\
\underline{56} \\
40 \\
\underline{35} \\
50 \\
\underline{49} \\
1
\end{array}$$

Starting with the initial numerator of 1, the sequence of remainders is 1, 3, 2, 6, 4, 5, 1. But once this second 1 occurs, we are back in the original starting position, and now the same cycle will repeat itself until a remainder of 1 is again obtained, and so on. Therefore the value of $\frac{1}{7}$ is $.\overline{142857}$.

In fact what this argument shows is that any decimal expansion of a fraction must be either finite terminating or infinite repeating. This is true because if the division algorithm does not terminate after a finite number of steps, then at some point a remainder must repeat. Once a remainder repeats, we go through an infinite cycle in the division. This interesting and non-trivial result could not be understood if the calculations were done with a calculator.

Lesson 3: Infinite Sums

Having developed a technique for adding a finite set of fractions, we can now consider the problem of how to add infinitely many fractions. For example, what is the value of the following infinite sum:

$$\frac{1}{2}+\frac{1}{4}+\frac{1}{8}+\frac{1}{16}+\frac{1}{32}+\cdots$$

Of course we know that it is only possible to add a finite set of numbers, so how can we assign a value to the above expression? We can do it by creating a sequence of finite sums, with each new sum containing one more term than the previous one, then taking the limit of these sequence values as we include more and more terms. For our example the sums are

$$\frac{1}{2}$$
$$\frac{1}{2}+\frac{1}{4}=\frac{2}{4}+\frac{1}{4}=\frac{3}{4}$$
$$\frac{1}{2}+\frac{1}{4}+\frac{1}{8}=\frac{4}{8}+\frac{2}{8}+\frac{1}{8}=\frac{7}{8}$$
$$\frac{1}{2}+\frac{1}{4}+\frac{1}{8}+\frac{1}{16}=\frac{8}{16}+\frac{4}{16}+\frac{2}{16}+\frac{1}{16}=\frac{15}{16}$$
$$\frac{1}{2}+\frac{1}{4}+\frac{1}{8}+\frac{1}{16}+\frac{1}{32}=\frac{16}{32}+\frac{8}{32}+\frac{4}{32}+\frac{2}{32}+\frac{1}{32}=\frac{31}{32}$$
$$\cdots$$

Notice that in each calculation we had to find a common denominator for the fractions being added. Now we can determine the value of the infinite sum. As the number of terms being added increases, both the numerator and denominator of the resulting finite sum increase in size. However, at each stage the numerator is always one less than the denominator.

It follows that the infinite sum has a limiting value of 1 since the finite sums get closer and closer to the value of 1, even though they never reach the value 1.

What we have done in this problem is to introduce the concept of a limit: something that can be approached but never quite reached. This concept is the foundation for calculus and mathematical analysis.

It would seem that the above example is one in which the calculator would be an effective tool for computing the finite sums to see if a limit is being approached. However, there are infinite sums for which the calculator will give a misleading result. This will happen if the finite sums grow larger and larger towards infinity, but do so at a very slow rate. One such example is the infinite sum

$$\frac{1}{1} + \frac{1}{2} + \frac{1}{3} + \frac{1}{4} + \frac{1}{5} + \cdots$$

It can be shown that we can always find a finite sum that is larger than any given specified value; in particular we can find a finite sum that exceeds the value 100. However, in order to exceed this value our finite sum would need to contain more than 1,000,000,000,000,000,000,000,000,000,000,000 terms. Obviously no calculator could be used to process so many terms.

Now we will consider two problems from algebra. In a typical algebra problem we are given some information about an unknown quantity. This information must be used to determine an equation satisfied by the unknown quantity.

Lesson 4: Gauss's Early Discovery

One of the best known mathematical anecdotes relates how the great mathematician Carl Friedrich Gauss (1777 - 1855) made a remarkable discovery as a child. According to the story, Gauss's teacher needed some free time to do some paperwork so he assigned the class the difficult arithmetic of finding the sum of the first 100 integers. The teacher assumed that the problem would keep the class occupied for at least an hour. Imagine his surprise when the young Gauss appeared at his desk after a few minutes and presented him with the correct answer! How did Gauss do it?

Gauss's insightful solution is a simple demonstration of the power of algebra. The unknown quantity in the problem is the sum of the first 100 integers, i.e., $1+2+3+\cdots+98+99+100$. In algebra we always use a letter to represent an unknown quantity, so let S denote the sum of the first 100 integers. Then $S = 1+2+3+\cdots+98+99+100$.

Gauss realized that the same sum would be obtained if the numbers were added in the reverse order:

$$S = 100+99+98+\cdots+3+2+1.$$

If we write the second equation directly below the first, then add the equations by adding corresponding entries in each column, a simple result follows.

first equation: $S = 1 + 2 + 3 + \cdots + 98 + 99 + 100$

second equation: $S = 100 + 99 + 98 + \cdots + 3 + 2 + 1$

third equation: $2S = 101 + 101 + 101 + \cdots + 101 + 101 + 101$

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The third equation states that $2S$ is the sum of 101 listed 100 times (once for each column). Therefore $2S = (100)(101)$. If we divide each side of the last statement by 2, then we obtain the same result that Gauss found:

$$S = \frac{(100)(101)}{2} = (50)(101) = 5{,}050$$

Therefore the sum of the first 100 integers is 5,050.

This method can easily be generalized to find the sum of any number of consecutive integers staring with 1. Let S denote the sum of the first n integers. First we write the equation for S as an ascending sum, then we write the equation for S as a descending sum. If we add the two equations column by column, we obtain a value for $2S$.

$$\begin{array}{rcccccccccccc} S = & 1 & + & 2 & + & 3 & + \cdots + & (n-2) & + & (n-1) & + & n \\ S = & n & + & (n-1) & + & (n-2) & + \cdots + & 3 & + & 2 & + & 1 \\ \hline 2S = & (n+1) & + & (n+1) & + & (n+1) & + \cdots + & (n+1) & + & (n+1) & + & (n+1) \end{array}$$

How many $(n+1)$'s are there? There is an $(n+1)$ for each column, so there are n $(n+1)$'s. Therefore

$$2S = n(n+1)$$

and $S = \dfrac{n(n+1)}{2}$.

If we want the sum of the first 500 integers, we replace n with 500 in the formula: $S = \dfrac{(500)(501)}{2} = 125{,}250$.

Gauss's solution is a beautiful illustration of why it is important to think about what a calculation involves before actually doing it. Sometimes this is lost sight of when students rush to use their calculators.

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Lesson 5: The Mixture Problem

Perhaps more than any other type of problem students dread algebra word problems. This is unfortunate because many of these problems require only elementary calculations and share a common structure that is easy to illustrate. Typical of this group of problems is the mixture problem, an example of which is given below.

A box contains a total of 40 nickels and dimes with a combined value of $3.60. How many of each type are in the box?

As in the previous lesson, we want to represent the unknown quantities by letters. This time there are two unknown quantities: the number of dimes and the number of nickels. We introduce letters d, n with d = the number of dimes,
n = the number of nickels.

Since we have two unknowns, we will need two equations to find the solution. Each equation will come from a factual statement in the problem. We can set up a box chart to represent the given information.

coin	number	value
nickels	n	$5n$
dimes	d	$10d$
total	40	360

Note that we have expressed the monetary values in cents so that we can avoid the decimals. Our two equations come from summing the columns.

The total number of coins is 40: $n + d = 40$

The total value of the coins is 380: $5n + 10d = 360$.

If we multiply the first equation by -5, rewrite the second equation, then add these equations we obtain

$$\begin{array}{r} -5n - 5d = -200 \\ 5n + 10d = 360 \\ \hline 5d = 160 \end{array}$$

Dividing by 5 now yields $d = \frac{160}{5} = 32$.

Since $n + d = 40$, we must have $n = 8$.

There are 8 ;nickels and 32 dimes in the box. This checks out since the combined value is then $8(5) + 32(10) = 360¢$.

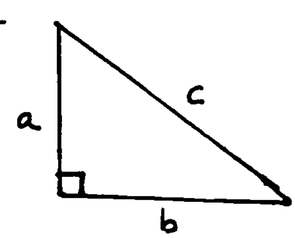
The interested reader should try to use the above box chart method to solve the following problems.

1. A box contains a total of 24 dimes and quarters with a combined value of $3.30. How many of each type are there?

2. A 10 pound mixture of nuts has a value of $36. The mixture consists of cashews selling at $4 per pound and peanuts selling at $3 per pound. How many pounds of each type are in the mixture?

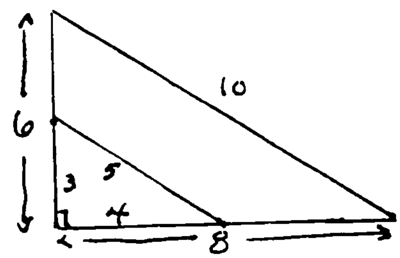
<u>Lesson 6: Pythagorean Triples</u>

The Pythagorean Theorem is one of the most well-known results in Euclidean geometry. It expresses the relationship that exists among the three sides of a right triangle.If we denote the two shorter sides by a and b, and the long side by c, then the theorem states that $a^2 + b^2 = c^2$.



Are there any solutions to the above formula with a, b, and c all positive integers? You may recall from high school that a = 3, b = 4, c = 5 is such a solution since $3^2 + 4^2 = 5^2$. We will denote this solution by the triple (3,4,5) and refer to it as a Pythagorean triple.

It's easy to see that we can use the triple (3,4,5) to generate other Pythagorean triples. If we double the sides of the 3-4-5 right triangle, we will obtain a 6-8-10 right triangle.



Therefore $6^2+8^2=10^2$, so (6,8,10) is a Pythagorean triple. Similarly we see that (9,12,15), (12,16,20), (15,20,25),... are all Pythagorean triples.

Since these new triples are multiples of the basic (3,4,5) triple, we are not too interested in them; instead we are more concerned with listing the "primitive" Pythagorean triples. The term "primitive" means that the numbers a, b, and c don't have a common factor. It is not too hard to show that each primitive triple (a,b,c) must have c = odd and exactly one of a, b even and the other odd. Let's assume we label so that b is the even value. Then it is possible to obtain a complete description of all primitive Pythagorean triples.

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All primitive Pythagorean triples can be found by the following method. Choose positive integers x and y satisfying the following three conditions:

(1) x is greater than y.

(2) x is even and y is odd or x is odd and y is even.

(3) x and y are not divisible by a common factor.

Then $a=x^2-y^2$, $b=2xy$, $c=x^2+y^2$ yields all primitive triples.

As an illustration, the table below lists all primitive triples obtained for values of x up to 5.

x	y	$a=x^2-y^2$	$b=2xy$	$c=x^2+y^2$
2	1	3	4	5
3	2	5	12	13
4	1	15	8	17
4	3	7	24	25
5	2	21	20	29
5	4	9	40	41

Just as surprising as the formula is the fact that the ancient Babylonians had a method for generating laree primitive triples. A cuneiform tablet dating from 1500 B.C. contains a list of triples including (3,4,5) and (4961, 6480, 8161).

The French mathematician Pierre de Fermat (1601 - 1665) generalized the Pythagorean triple problem by looking for positive integer solutions to the equation $a^n+b^n=c^n$ when the exponent n is greater than 2. Sometime in the 1630's he conjectured that for all such values of n not one single solution exists. Fermat claimed to have a proof of his conjecture, but he never published it and no written proof was ever found in his surviving papers. His conjecture became one of the great problems of mathematics and remained unsolved for more than three centuries. Finally in 1995 Professor Andrew Wiles of Princeton University proved that Fermat's Conjecture was true.

At this point I would like to summarize my view towards calculators and mathematics. I have tried to show in this paper that mathematical ideas can be recognized and understood without the use of "high tech" calculators. On the other hand, I use a calculator, and in most of the courses that I teach I allow my students to use a calculator. Calculators are fast and accurate, and when properly used they allow students to bypass tedious arithmetic and get to the important concepts in a problem. However, we as educators must be careful not to let the new technology become the driving force in the curriculum. The focus must always be on conceptual mathematical understanding.

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Writing-Across-the-Curriculum at Union County College
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Fall 1998 - Spring 1999

I. Introduction

Writing-Across-the-Curriculum (WAC) became popular in American colleges and universities in the mid 1970's in response to a perceived deficiency in students' thinking and writing skills. WAC functions on two governing principles: 1.) writing to improve thinking and writing skills, and 2.) writing as a learning tool. For WAC, writing does not simply mean writing for a grade. All kinds of writing can take place in a writing intensive course such as, note-taking, making lists, journal writing, short response writing, and essays, and these assignments can be graded or ungraded.

In the twenty-five years since WAC was introduced to U.S. educators, there have been many colleges and universities which have been able to sustain their WAC programs while other programs have failed inspite of a promising start. Since Union County College belongs to the latter group, this paper will offer a model for Writing-Across-the-Curriculum which will be meaningful for faculty and students at Union County College.

II. The History of WAC at UCC

A. In the Summer of 1978, Karl Oelke, a senior Professor in the English Department at Union County College, ran a series of Writing Across the Curriculum workshops at UCC. These workshops were the results of several WAC workshops he had attended earlier that year. By having these workshops, Karl hoped to begin a WAC movement at UCC. The two workshops ran for three summers with 25% - 30% of the faculty sharing ideas and discussing ways for using writing as a learning tool.

After ten years, there were enough faculty involved in the workshops, and many of them were using writing in their courses, so in the Spring of 1988 an adhoc committee was sent up to draft a Writing Across the Curriculum policy. The policy was eventually approved at a full-faculty meeting, and it went into effect in the Fall 1988. The written policy became apart of the 1988-89 UCC faculty and student handbooks. In the faculty handbook the policy stressed the importance of writing in the academic lives of students at Union County College. It read,

> "Writing to learn as well as writing for a grade will be components of courses in every discipline and faculty members will insure that students' passing grades in courses where writing is in any way appropriate will reflect their ability to express themselves clearly and correctly in writing" (Copy of the written policy sent from Karl Oelke to Dean Wynn Phillips for the 1988-89 UCC Faculty Handbook).

In the 1988-89 UCC Student Handbook, there was a general statement on writing which identifies the different reasons why students write (i.e. to remind yourself of something, to sort things out, to convey information or ideas, etc) and the different forms of writing (i.e. notes, lists, letters, college papers and reports). However, the WAC policy for students was not as specific as it had been illustrated to faculty. The student policy reads, "At Union County College, you'll discover two kinds of writing, Writing to Learn and Writing for Publication" (pg. 15).

Now, some twenty-one years after the first WAC workshop at UCC and eleven years since the faculty approved the Writing-Across-the-Curriculum Policy, there is little evidence that WAC as a college-wide movement existed at all. The written policy that was once apart of the 1988-1989 UCC Student and Faculty Handbooks has not been included in the handbooks since. In terms of the faculty's commitment to WAC in the classroom, I am sure that there are some faculty in other disciplines who have students do some form of writing in their courses; however, whether a majority of the faculty are doing it is questionable. When I interviewed Karl even he questioned whether the policy had a serious impact in the classroom or on the curriculum at UCC. Nowadays when asked by other departments, Karl gives workshops to various departments, showing non-English faculty how to respond to students' writing; however, there is no campus-wide effort for WAC.

There are probably several reasons why WAC at Union County College lost its momentum. It might have helped for the WAC Policy to identify more specific requirements in terms of the amount of writing students were expected to produce. Another problem might have been the lack of follow-ups workshops, and a lack of dialogue between the faculty in terms of what was happening in the writing intensive courses. In the WAC policy at UCC the responsibility for implementation was left up to each department which is the way it should be; however, the departments neither specified guidelines nor set up a method for evaluating writing intensive courses.

III. Faculty Views on the Teaching of Writing

Before proposing a model for Writing-Across-the-Curriculum, I wanted to find out how the faculty at Union County College view the teaching of writing and the role of writing in the classroom. To gain some insight in these areas, I conducted a survey in the Spring 1999 similar to a survey given at Tarrant County Junior College in Texas. Sixty-two faculty members at Union County College participated in the survey. Thirty-seven are full-time faculty and twenty-five are adjunct faculty. Twenty-eight of the sixty-two faculty surveyed teach English ranging from developmental, ESL (English as a

Second Language), and traditional English (i.e. Composition and Literature). Thirty-four of the faculty who participated in the survey teach in the Chemistry, Biology, Physics, Nursing, Continuing Education, Math, Business, History, and the Psychology/Sociology Departments.

Overall, the faculty had very positive responses to the survey (see Appendix 1). Ninety-three percent of the faculty agreed to the statement, "Writing is applicable to my field of instruction". Sixty-two percent of the faculty agreed writing should be taught in any and all classes. On the surveys, some faculty commented on the ambiguity of the word "taught"; however, by this I meant taught as either explaining how to write or assigning writing. One does not necessarily have to know how to teach the mechanics of grammar and composition in order to teach a writing intensive course. Many of the faculty are aware of this which probably explains why eight-two percent of the faculty agreed that there is a difference between using writing and teaching writing. Seventy-six percent of the faculty agreed that poor student writing is a problem in their classes, and eight-one percent agreed to the statement, "writing in my class would be time well spent."

Since I was particularly interested in how faculty in disciplines other than English, felt about the teaching of writing, I decided to compare the surveys of English faculty with non-English faculty (see Appendix 2). The results of this comparison, although not surprising, proved to be insightful.

Eighty percent of the English faculty agreed writing should be taught in any and all classes while only fifty-eight percent of non-English faculty agreed. Ninety-six percent of English faculty agreed that writing in their classes would be time well spent while only sixty-nine percent of non-English faculty agreed. Even more interesting are the responses to faculty preparedness and their perceptions of student writing skills. Ninety-six percent of the English faculty felt equipped to teach writing, and sixty-five percent agreed that poor student writing is a problem. These results are not surprising since English faculty are trained in this area, and it's perceived to be their job to teach students how to become better writers. However, the fact still remains that sixty-five percent of English faculty felt poor student writing is a problem. Again, this is not surprising since eighty percent of students at Union County College test into at least one or more developmental courses in their freshmen year, and as faculty, we can not expect our students to be exceptional writer even after they have passed standardized exams, and freshman composition. Writing is a process, and becoming a good writer takes a lot of time and practice.

Only thirty-five percent of non-English faculty felt equipped to teach writing; however, I must add that some faculty in other disciplines may have very traditional notions of what it means to teach writing even if they know that there is a difference between teaching writing and using writing They may feel that teaching writing means having extensive knowledge about the rules of grammar and a familiarity with composition theory. However, assigning a paper and having students do revisions is in fact teaching writing. Eighty-three percent of non-English faculty agreed that poor student writing is a problem in their classes. With such a large percentage among non-English faculty, I feel that it is important for The College to address these issues. How do we get our students to become better writers? Moreover, how can we prepare non-English faculty to teach writing?

Many of the faculty who participated in the survey are interested in addressing these questions. Eighty-one percent of English faculty and sixty-five percent of non-English faculty are interested in finding out more about improving teaching and learning. Moreover, seventy-one percent of non-English faculty and eighty percent of English faculty are willing to share ideas and assignments with colleagues in other fields. These results show that there is a community of faculty at Union County College who is willing to begin a dialogue where they address the problems of poor student writing and faculty preparedness.

IV. A Model for Writing-Across-the-Curriculum at Union County College

Most successful Writing Across the Curriculum Programs whether they are at two or four year institutions have at least five components which have contributed to their longevity:

1.) writing intensive courses in the disciplines which outline the specific goals of the courses;
2.). faculty workshops where faculty come together to write, and discuss pedagogy;
3.) a committee which overseas the evaluations of writing intensive courses and faculty workshops
4.) a Writing Center which supports faculty efforts to integrate writing into their courses;
5.) a newsletter which can communicate/share the successes of WAC with the faculty and the college community.

In the past, Union County College had at least three of these components; however, in order to reinstitutionalize WAC at Union County College, all five components have to maximized to their fullest capacity. For example, the goals and objectives of writing intensive courses need to be specific for faculty in the Faculty Handbook, and at workshops, so faculty can begin to think about how to either construct writing intensive courses for existing courses or so they can develop new courses which are writing intensive.

Moreover, the goals and objectives need to be specific for students in the Student Handbook and on the syllabus so students can know what is expected of them in these courses. Any writing intensive courses should be guided by these 5 basis principles:

1. Students should do a significant amount of writing where they are writing a minimum of 2500 words per semester.
2. Writing should be spread out across the semester. For example:
    a. Have students write several short papers or perhaps a short exercise every week.
    b. Have students write a term paper by turning in draft sections at intervals across the semester.
    c. Have students summarize a lecture, a reading assignment, write a personal response, write a lab exercise, or write a series of questions of their own about the course material.
3. Faculty should provide some instruction in writing. This could take shape in several ways:
    a. Handout and review checklists that set forth the instructor's expectations for writing in the course.
    b. Handout and review sample essays.
    c. Discuss with students the kinds of writing done in the discipline.
    d. Ask students to revise and resubmit papers.
4. Faculty should provide timely responses to student writing. Responses to student essays are most useful when they address communication rather than mechanics. In the essays, identify where communication has gone well or badly.
5. Student writing should be a factor in determining the final grade for the course.

There should also be three faculty workshops held during the year. Faculty should be encourage to attend these workshops, particularly summer workshops, before teaching a writing-intensive course. The overall goal of the workshops is for faculty to take something back to the classroom in the fall or spring semester. More specifically though, the summer workshops can be designed with at least five goals. The first goal is to introduce faculty to the philosophy of WAC because some of the faculty may not be familiar with this, and usually faculty are more willing to participate in projects and support a movement if they are educated in its philosophy. The second goal would be to share ideas on what constitutes exemplary writing across the disciplines. Even though there may be differences in this area across and perhaps even within disciplines, it is important that we begin a dialogue if we are to move towards a standardized criteria in this area. The third goal of the workshops would be to have faculty write together, and perhaps peer review each other's work. While peer review can be optional, I believe it is essential for faculty to spend more time writing together and sharing the results of this experience with each other. The fourth goal of the summer workshops would be to discuss strategies for responding to student writing, and this goal can be accomplished with some discussion on the literature in this area and with some of the English faculty offering suggestions. The fifth goal would be to have faculty design a writing intensive courses. To do this, they would need to explore some very general questions which can be applied to any course at any level across the disciplines. These questions are:

1. What are the goals of the course?
2. What kinds of writing and how much wiil the course require?
3. How will writing assignments be integrated into the subject matter of the course?
4. Does the nature of the course favor certain kinds of writing assignments?
5. In what way(s) will students learn how to write better or receive instruction in writing?
6. How will students writing be evaluated?

This are just a few of the basis questions faculty can begin to think about as they are developing writing intensive courses. However, it will be up to them to decide what specific assignments will work best for the courses they will teach.

Midsemester workshops can focus on concerns faculty may have about grading or responding to students writing. However, a major focus should be on sharing their successes (or difficulties) with assignments they have given to students as well as discussing successes (or difficulties) with student essays. With faculty permission, some of the writing assignments they have assigned can be submitted to the WAC Newsletter as a way to offer ideas to other faculty in their disciplines.

A Writing-Across-the-Curriculum Committee is also important to the success of WAC at Union County College. It will be responsible for organizing three yearly workshop, designing student and faculty surveys for writing intensive courses, reporting the results of the survey in the WAC Newsletter, and designing and distributing the WAC Newsletter to faculty twice a year.

Since Union County College has an Academic Learning Center on all campuses, it is important for faculty to encourage students to take advantages of these facilities. The ALC has trained writing tutors who can help students at any stage of the writing process. Of course, teaching a writing intensive class will be a lot work for faculty, but those students whose writing is most problematic can be referred to the ALC to work with a tutor. Tutors can be a bridge between faculty and students, helping students to communicate more effectively and thereby supporting faculty in their efforts to integrate writing into their courses.

The WAC Newsletter will be instrumental in disseminating ideas to the faculty. This can be published at the end of each semester, reporting the results from faculty and student surveys. Also faculty can submit writing assignments they have used for their courses. The newsletter can announce workshop dates and topics to be discussed, as well as announce upcoming local and national conferences on writing.

V. Conclusion

Writing-Across-the-Curriculum at Union County College has the potential for success and longevity if we commit ourselves to teaching writing intensive courses and commit ourselves to the follow-up activities outlined in this paper. When I first began this project, I wanted to find out if there were faculty at Union County College who would be interested in committing themselves to this kind of work. Certainly, the surveys that I distributed to the faculty has shown that there is a community at UCC who is interested in using writing in their courses and teaching students to become better writer. If we want to prepare our students for careers or for advanced degrees at four year institutions where, in either arena, they will be asked to express themselves in writing, then we need to move in this direction. This will not be an easy task, but Writing-Across-the-Curriculum can certainly be a start.

Appendix 1

Faculty Survey: Results

Total results from 62 faculty members: Full-time - 37; Part-Time 25

1. Writing should be taught in any and all classes.
67% Agree 26% Disagree 5% Don't know 2% No Answer

2. Writing in my class would be time well spent.
81% Agree 11% Disagree 6% Don't know 2% No answer

3. There is a difference between using writing and teaching writing.
82% Agree 5% Disagree 10% Don't know 3% No answer

4. I do feel equipped to teach writing.
63% Agree 24% Disagree 13% Don't know

5. Writing is applicable to my field of instruction.
93% Agree 5% Disagree 2% No Answer

6. Poor student writing is a problem in my classes.
76% Agree 16% Disagree 3% Don't know 3% Sort of 2% No Answer

7. I would be interested in finding out more about using writing to improve teaching and learning.
72% Yes 13% No 15% Maybe

8. I would be willing to share ideas and assignments with colleagues in other fields.
74% Yes 6% No 20% Maybe

Appendix 2

Faculty Survey: Results 2

28 = English (13 full-time; 15 part-time)
34 = non-English (24 full-time; 10 part-time)

1. Writing should be taught in any and all classes.

English: 80% Agree 20% Disagree
non-English: 58% Agree 30% Disagree 9% Don't know 3% No Answer

2. Writing in my class would be time well spent.

English: 96% Agree 4% Disagree
non-English: 69% Agree 17% Disagree 11% Don't know 3% No Answer

3. There is a difference between using writing and teaching writing.

English: 81% Agree 8% Disagree 3% Don't know 8% No Answer
non-English: 82% Agree 3% Disagree 15% Don't know

4. I do feel equipped to teach writing.
English: 96% Agree 4% Disagree
non-English: 35% Agree 41% Disagree 24% Don't know

5. Writing is applicable to my field of instruction.
English: 100% Agree
non-English: 88% Agree 9% Disagree3% No Answer

6. Poor student writing is a problem in my classes.
English: 65% Agree 24% Disagree 8% Sort of 3% No Answer
nonEng: 83% Agree 9% Disagree 3% Sort of 5% Don't know

Faculty Survey: Results 2 cont'

7. I would be interested in finding out more about using writing to improve teaching and learning.

English:	81% Yes	11% No	8% Maybe
non-English:	65% Yes	15% No	20% Maybe

8. I would be willing to share ideas and assignments with colleagues in other fields.

English:	80% Yes	20% Maybe	
non-English:	71% Yes	17% Maybe	12% No

By Departments:

English: 28	Physics: 2	Math: 8	Psy/Soc: 5
Chemistry: 4	Nursing: 2	Business: 7	
Biology: 4	Continuing Ed: 1	History: 1	

NON-TRADITIONAL TEACHING STYLES IN PHYSICS

by

Bruce R. Boller

Bergen Community College

Mid-Career Fellowship Program (1998-1999)

Princeton University

May 1999

NON-TRADITIONAL TEACHING STYLES IN PHYSICS

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Introduction

The last two decades have witnessed a growing trend that is away from the traditional modes of instruction in physics courses at all levels, from high schools through universities. The reasons for this will be mentioned in the following section. In addition, this paper will provide some commentary on several non-traditional styles of physics instruction. This is not to be viewed as an attempt to promote any one single style over another because it is clear from numerous sources that almost any form of interactive learning produces improved conceptual understanding.[1] The purpose here is to present some of what is currently being done in physics education and to present, as much as is possible, some quantitative results. Overall assessment and recommendations for the community colleges are presented at the end of the paper.

The Eye Opener and Peer Instruction

Now, imagine that it is 1990 and you are a professor of physics at Harvard University who has been teaching the calculus-based physics courses for six years. You firmly believe that your students are receiving the best instruction possible, and furthermore, you also firmly believe that your students have not only developed problem solving skills but they are also capable of answering questions about the most basic and elementary physics concepts. After all, you taught them.

You read a series of articles by Halloun and Hestenes[2] that more than arouses your curiosity about your "firm" beliefs concerning your students' basic knowledge of physics. The authors claim that traditional teaching styles do not improve the students' understanding of the basic concepts in the first semester of a calculus-based physics course. The misconceptions that students have concerning physics before taking a class in physics seem to persist after traditional instruction even for physics majors on and into graduate school.[3] The students are capable of answering algebraic and numerical problems but they have a great deal of difficulty with conceptual questions. These authors provide a Mechanics Diagnostic Test that may be used to explore students' concepts in physics. You decide to use their diagnostic test to prove to yourself that your students could not possibly do poorly on this type of exam. The results of the test come to you as a complete shock. How could your students do well on conventional problem solving and, at the same time, have no basic understanding of the underlying physics? Even good students had trouble with the test. You begin to realize that, your thorough, complete, and coherent lectures notwithstanding, there is a serious problem in physics education using traditional lecturing styles.

This "eye opening" realization confronted Professor Eric Mazur who has subsequently published a book[4] concerning his efforts to fix this deplorable situation using non-traditional teaching and learning styles. His lectures consist of short presentations on key points followed by a *Concep Test* containing short conceptual questions on the previous material. Students are given time to formulate answers and discuss them with each other. The *Concep Test* has the following general format;[5]

1.	Question posed	1 minute
2.	Students given time to think	1 minute
3.	Students record individual answers (optional)	
4.	Students convince their neighbors (peer instruction)	1-2 minutes
5.	Students record revised answers (optional)	
6.	Feedback to teacher: Tally of answers	
7.	Explanation of correct answer	2+ minutes

The *Concep Tests* take up about one third of each class so that a choice must be made about coverage of the material for the course. Mazur selectively covers certain key topics leaving the rest of the material, including worked examples and most derivations, for the students to read and study, just as they must do in other courses.[6] This may not work as well at the community college level where practically every student works at least 20 hours per week.

Collaborative Instruction

Attendance at the Faculty College in 1992 gave me exposure to the idea of non-traditional teaching styles from many disciplines, but none from physics. The topic that summer focused on the results of research done by educators on the learning styles of students. I, like Mazur, thought that my lectures were the best possible for student instruction in physics. The papers that Mazur read had slipped by me. However, attendance at the Faculty College made me curious, so I subsequently developed a series of conceptual questions to be used as pre- and post-semester tools for assessing the value gained by the students in the first semester of the calculus-based physics sequence. The pre- and post-semester tests were administered to classes taught in the traditional style as well as classes taught in a non-traditional style. The non-traditional style made use of collaborative exercises in physics which the students worked on in six groups numbering about four students per group. These exercises were generally on material previously lectured upon and discussed in class, or in some cases, on material from reading assignments. About 10 to 15 minutes of time was allowed for each exercise with the instructor walking around to each group offering corrections to work already done or suggestions as to how the students should proceed. The students became active learners rather than passive ones.

Professor Paul D'Alessandris at Monroe Community College is the only other person that I know nearby who uses something similar to collaborative exercises.[7]

Overview Case Studies (OCS) and Active Learning Problem Sets (ALPS)

Alan Van Heuvelen originally at New Mexico State University and now at Ohio State University has been deeply involved with a departmental effort involving 30% of the faculty to improve all introductory physics courses. Use is made of collaborative peer instruction and employment of undergraduate students to augment the instructional staff.[8] In addition, use is made of Van Heuvelen's Overview Case Studies[9] and his Active

Learning Problem Sets[10] with context-rich problems, and interactive simulations with worksheets.[11]

Professor Ronald Gautreau at New Jersey Institute of Technology has been using OCS and ALPS for a number of years with great success. The ALPS are used in the first semester of the calculus-based physics sequence for a period of about four weeks to develop solid conceptual understandings of motion. He is convinced that student learning has greatly improved because of his change to a non-traditional teaching and learning style.

Tutorials

Lillian McDermott and her collaborators of the Physics Education Group at the University of Washington have made careful studies of students' understanding of Newton's laws of motion, particularly Newton's third law of motion (action and reaction).[12] Conceptual and reasoning difficulties of the students were identified using carefully designed questions. McDermott's group has successfully diminished those difficulties by designing research-based worksheets which guide the students through the kind of questioning, analysis, and experimentation that is necessary to solidify the concepts involved. Although the University of Washington still uses the large lecture format, they have replaced recitations by tutorials where students work in groups of three or four on the carefully designed research-based worksheets.[13] Students must make predictions and consider various lines of reasoning in order to gain an understanding of the basic concepts in physics.[14]

Workshop Physics[15]

On February 19, 1999 I visited one of the workshop physics classes at Dickinson College in Carlisle, Pennsylvania. The class was taught by Hans Pfister who graciously permitted me to sit in on the two-hour session. This class was in the second semester of a two-semester calculus-based physics sequence. The subject was Kirchhoff's Laws, related to electric circuits. The room had six work stations equipped with microcomputers and the apparatus necessary for the students to conduct their inquiries. The room also had a very large open area in the middle. I learned later that this large open area was used for kinesthetic experiments and demonstrations. The kinesthetic experiments were done mostly in the first semester whereby students became actively involved in various experiments dealing with motion and forces. The students experienced motion and forces acting on them in a very direct way through a series of carefully designed activities.

During my visit, Professor Pfister explained the nature of electric circuits and Kirchhoff's Laws at the beginning of the class using a lecture style not too different than anyone else's, using straight lecture, simple board techniques, a model circuit, all interspersed with leading questions to individual students. When the explanation was completed the students began working on questions in their workshop physics activity guides.[16] They then began building some simple circuits to test the validity of Kirchhoff's Laws. During this time Professor Pfister and teaching assistants (upper level students who previously took the course) visited each group to help with concepts and the correct use of the equipment.

The students are graded on homework assignments, the activity guides, and regular examinations. The classes meet three times per week for two hours each. There was a very friendly and open atmosphere between the students, the TA's and the Professor. Most of the "real" learning was done by the students in the social atmosphere of the peer group. Unfinished experimental data could be obtained after class hours because the workshop physics room was continually "manned" by the TA's.

Expert versus Student Problem Solving

A study was conducted by Larkin and Reif at the University of California, Berkeley and later at Carnegie-Mellon University to compare the problem-solving approach of an expert with that of an excellent student.[17] They discovered that the expert made use of an understanding of physics concepts and a well-developed knowledge structure of how the physics fits together as opposed to the student who used superficial mathematical manipulations without deeper understanding.[18] Consequently much effort has been expended over the last 20 years into identifying the fundamental concepts and the difficulties that students have with them. Lillian McDermott and the Physics Education Group at the University of Washington have spearheaded research in this area.[19] It is to be pointed out that additional research must be done on many topics, including students' ability to apply concepts in problem solving, students' reasoning and their use of mathematics in problem solving, as well as the impact of technological improvements on what students learn.[20]

Results

Because of the previous research on the conceptual component necessary for problem solving, David Hestenes, Malcolm Wells, and Gregg Swackhamer[21] have developed the best currently available conceptual assessment test[22] to be used in the first semester of an introductory physics sequence. It is suggested[23] that this 29 question test, the Force Concept Inventory (FCI), be given at the very beginning of the semester and then later on at about mid-semester or toward the end of the semester for evaluating students' conceptual gains in understanding basic physics principles.

Hake[24] has developed a basic measure for evaluating the gain in conceptual knowledge about physics using the FCI test. Boller has previously used the exact same measure for evaluating the gain on his own conceptual exam. This measure is known as the Hake factor, h, as coined by Redish and Steinberg.[25] The Hake factor is defined as follows:

$$h = \frac{\text{post-test\%} - \text{pre-test\%}}{100\% - \text{pre-test\%}}$$

The results are given in the following table.

Instructional Type	Hake Factor
Traditional Instruction	0.16 ± 0.03[26]
Peer Instruction	0.56[27]
Collaborative Instruction	0.32[28]
OCS, ALPS	0.42[29]
Tutorials	0.35 ± 0.03[30]
Workshop Physics	0.41 ± 0.02[31]

It is clear that there is a significant gain in the conceptual understanding for those students enrolled in the non-traditional courses presented in this paper. There are other non-traditional instructional methods that have not been specifically addressed, such as the tools for scientific thinking developed by Thornton and Sokoloff.[32] It is emphasized that this is only the first step in a long process devoted to the identification of those methods which work best to attain the very best in physics instruction.

Traditional Style Comments

One difficulty with the traditional style of teaching lies with the information written down on the board by the instructor. Usually, in physics, this information is in the form of equations. The students carefully copy these equations into their notes but neglect the extremely important words spoken by the instructor about the equations, such as how they came to be, what they mean, how they are to be applied, and their limitations.

Another problem confronting the implementation of non-traditional styles into two year colleges is the perception by physics instructors that such methods are being used to replace work done by the students outside of the classroom because of the extremely high working hours borne by the students. But, it is clear from the recent evidence in physics education research that the students' exposure to non-traditional teaching methods will improve their conceptual and appropriate cognitive attitudes which are necessary to improve their problem solving skills.[33]

Goals of Physics Instruction, Personal Assessment

The following table includes nine important skills that I consider to be extremely important goals for students to be able to achieve in their introductory calculus-based physics courses. The degree of success of the traditional versus the non-traditional styles of physics instruction at achieving the goals are qualitatively compared.

GOAL	TRADITIONAL	NON-TRADITIONAL
Conceptual understanding of physics	poor	excellent (all)
Interpretation and construction of graphs	poor	excellent (all)
Data analysis	poor-average	excellent (Workshop Physics)
Numerical computation	average	excellent (Workshop Physics)
Computer skills and software application	poor-average	excellent (Workshop Physics)
Simple algebraic solutions to problems (one step)	not assessed	not assessed
Involved algebraic solutions to problems (two or more steps)	not assessed	not assessed
Detailed algebraic solutions to problems from first principles	not assessed	not assessed
Derivations of formulae or detailed algebraic solutions to problems involving calculus	not assessed	not assessed

These evaluations have been done on the basis of what is currently being written about in the literature. It is clear that much remains to be done in physics education research to further improve physics instruction.

Summary and Recommendations

There is one common thread that runs through the various non-traditional teaching styles in physics presented in this paper. All of them focus on interactive, experiential, and social models to improve conceptual understanding of the underlying physical principles and reasoning ability.

Four year colleges and universities have been at a tremendous disadvantage because of their large lecture classes. Their recitation classes, although smaller in size, offer no important gains in the teaching of physics if lecturing and problem solving by the instructor is merely "witnessed" by the students. "Serious conceptual and reasoning difficulties cannot be overcome through teaching by telling."[34]

The students at the community colleges have the same conceptual and reasoning difficulties as their counterparts at the four year colleges and universities. The community colleges have been fortunate, in that large lecture classes in physics are not the norm. In this sense, community colleges do not need to restructure large lecture classes. All that needs to be done is to focus upon one of the non-traditional models and implement it. Some models, such as Workshop Physics may be impractical because of the large staff needed to run such a program. Nevertheless, Carolyn Haas at Salem Community College is using a combination of workshop physics and tools for scientific thinking.[35] She is of the opinion that to be 100% successful, a stand-alone workshop physics curriculum needs a staff member for every 6-8 students.[36]

If the reader teaches physics, especially at the community college level, you are strongly urged to read the references cited in this paper. Begin with the articles by McDermott[37] and then proceed to Mazur's book which is a delightful 42 pages of quick but very informative reading, which even includes a sample "lecture." The rest of his book is devoted to various forms of tests, quizzes and exams, one of which was alluded to in this paper, namely the Force Concept Inventory Test (FCI). Mazur also includes a more advanced 26 question test called the Mechanics Baseline Test (MB). In addition to Mazur's book the Force Concept Inventory Test[38] and the Mechanics Baseline Test[39] are available for anyone to copy and use. The articles by Hake[40] and Redish and Steinberg[41] are excellent for their current analyses of the data as well as good sources for references, especially the article by Hake. A paper to be published by McDermott and Redish[42] in the American Journal of Physics promises to be the most comprehensive to date on this subject. It also contains more than 200 references. Look for it, or e-mail Redish for a preprint.

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Cheating And Its Vicissitudes

Academic Dishonesty at Raritan Valley
A Preliminary Report

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May 1999

Comprehensive surveys completed by McCabe and others during the past decade indicates that student cheating at American colleges is widespread and takes a variety of forms (McCabe and Trevino, 1996). These surveys indicate that approximately 50% of students have copied from others during an exam, that a third of students have helped other students cheat on an exam, a fourth have used crib notes during an exam, a fourth have plagiarized, and nearly a third have falsified a bibliography. In addition, one out of seven students have handed in work written by another student and claimed it as their own, and half have collaborated on projects when the instructor had specified that only individual work was acceptable.

Cheating at Raritan Valley Community College

Although a large percentage of students attending college do so at community colleges, few studies of academic dishonesty report any findings from this sector. There are questions therefore, as to how closely cheating at community colleges resembles that at four year colleges in both kind and quantity. In an effort to reveal this information, a survey similar to the one used by McCabe was administered to 298 students at Raritan Valley Community College in early December 1998. A summary of the results are indicated on the survey itself (see pages 7-12). Sixty nine percent of students at Raritan completing the survey were nearing the end of their first semester of college.

The survey indicates that actions traditionally associated as `classical cheating` – copying from another student on an exam with or without their compliance, was reported to have been committed at least once by 29% of Raritan Valley students. Twenty seven percent of students reported having used crib notes during exams. Sixty two percent of students reported seeing another student cheat.

Variants of classical cheating were more common. For instance, forty one percent reported receiving questions or answers (or both) from someone who had already taken the exam. Thirty nine percent said they had helped another student to cheat on an exam.

Plagiarism and it's variants was, in most cases, as common as simple cheating. Twenty nine percent of students reported copying material from elsewhere and submitting it as their own work, while thirty one percent reported having falsified a bibliography. More than half of the students surveyed claimed to have copied some material without footnoting it. In perhaps the most heinous form of academic deceit, thirteen percent of students reported having turned in the work of others as their own, while its reciprocal- writing or providing a paper for another student was admitted to by sixteen percent of respondents.

Other sundry forms of academic dishonesty are evident in varying quantities. Thirty eight percent of students collaborated with others even when they knew the instructor wanted individual work. Eighteen percent of students reported either copying the computer work of someone else or falsifying lab or research data. For the most part all of these activities were viewed as cheating by students, although collaborating with others on assignments was not seen to be as serious a transgression as individual acts of academic dishonesty. For almost all forms of deceit students reported that they were 'unlikely' or 'very unlikely' to be caught.

A comparison of cheating at Raritan compared to data McCabe has summarized from his surveys of non honor code four year colleges is revealing. Raritan students believe cheating and plagiarism is more common on their campus compared to their counterparts at four year institutions. Thirty four percent of Raritan students felt cheating occurred often or very often at R.V.C.C. In comparison, only 20% of students at four year colleges felt that cheating occurred that often on their campuses. Thirty nine percent of Raritan students felt that plagiarism occurred often or fairly often compared to twenty eight percent of the four year college students surveyed by McCabe.

Raritan students also appear to be more likely to help other students cheat. Thirty seven percent said they would either give answers directly to a student who asked during an exam, or expose their answer to a similar request. A significantly lower percent (6%) of students at four year colleges said they would respond in similar fashion to a request for answers from a fellow student during an exam. Fewer Raritan students than those at four year colleges said they would report a student they observed cheating. Only five percent of Raritan students said they would do so, compared to fourteen of students at four year colleges.

Fewer Raritan students also view cheating to be categorically unacceptable. Only seventy-two percent agreed with the statement 'under no circumstances is cheating justified'. Eighty seven percent of four year college students agreed with the same statement.

Students at Raritan appear to be less concerned with cheating in society at large than those at four year colleges. Twenty six percent of Raritan students agreed with the statement 'Cheating is common in American society. It is an acceptable way to get ahead'. Only sixteen percent of students at four colleges agreed with the same statement. Only eighteen percent of Raritan agreed with the statement ' I am bothered by the cheating that goes on here' compared to thirty nine percent of students at four year colleges who responded to the same statement.

The Faculty View

A survey of Raritan Valley faculty experiences and perceptions of student cheating was completed during the second week of February 1999. Thirty six of the fifty eight faculty (62%) who received the survey completed it. Members of departments representing the English, Social Science, Humanities, Science, and Business faculty responded. They averaged approximately 15 years of experience at Raritan, 36% having labored for 21 years or more. Their responses are summarized on the attached faculty survey (pages 12-15). Several of the questions are identical or nearly identical to those on the student survey. The resulting responses allow for some direct comparisons between student and faculty perceptions to be offered.

Generally, cheating does not appear to be an issue of great concern to the faculty. A quarter of the faculty reported never having observed cheating, and only 17% reported having observed cheating 'several times or more'. Only 12% agreed with the statement 'cheating is a serious problem at Raritan'.

Students at Raritan may have taken notice of the faculty's lack of concern regarding cheating. Only twelve percent of Raritan students said the most likely outcome taken by a Raritan instructor in response to student cheating would be to fail them for the course. Seventeen percent of students surveyed by McCabe at four year colleges said that students caught cheating would receive a failing grade for the course.

Although over 80% of the faculty said they were familiar with college policy on cheating and plagiarism and over 50% felt that the policy was fair, 50% rated the policy as less than effective and only 28% said they actually followed the policy when they observed cheating. For reasons yet to be fully determined the faculty do not seem to support the prescribed policy.

This lack of support of official Raritan policy was not directly addressed by the survey but informal discussions with faculty members are suggestive. Some faculty at Raritan told me that the administrative process that deals with academic dishonesty is overly bureaucratic and time consuming. In addition, faculty are unaccustomed to the lack of control they experience outside the classroom and sometimes uncomfortable and unwilling to participate in an administrative fact finding process. They would, they claim, prefer to spend their time in ways other than trying to prove a case of cheating they are certain to have occurred. Lastly, faculty sometimes feel that the administration is not always supportive of their charges against students, or harsh enough in sanctioning students determined to have cheated.

Summary

The survey data discussed above suggests (considering that 7 of 10 who responded were first semester students) that students at Raritan are as likely to cheat and plagiarize, if not more so, than students at four year colleges. They are more likely to help others cheat and less likely to report cheating committed by other students. The reasons for these attitudes and behaviors may in part be suggested by their acceptance of cheating in society at large. What is not known is whether Raritan is representative of community colleges, and therefore, whether more cheating and plagiarism occurs at two year than four year colleges. If this were to be true it suggests a possible relationship between the quality of student work and motivation and a willingness to cheat or accept cheating.

Another area that deserves further scrutiny is the large discrepancy between the amount of cheating committed or seen by students at Raritan compared to that observed by R.V.C.C.faculty. Is this discrepancy typical at community and four colleges, and if so, what accounts for these varied perspectives? Lastly, are there policies that are known to work at four year colleges in reducing academic dishonesty (e.g. honor codes) that could be implemented successfully at community colleges such as Raritan? These and other considerations suggested by the survey data are issues that need to be addressed.

RARITAN VALLEY COMMUNITY COLLEGE
ACADEMIC INTEGRITY SURVEY

SECTION I - BACKGROUND INFORMATION

1. **What was your status when you first enrolled at Raritan?**

   69% 1. First semester at any college or university (Please skip to question 3.)
   13% 2. Transferred to Raritan from another 2-year college
   13% 3. Transferred to Raritan from a 4-year college or university
   5% 4. Already had a college degree

2. **For how many semesters, including summers and this term, have you attended Raritan?**

   — Semesters

3. **What is your program of study here at Raritan?**

Liberal Arts	34.3 %
Education	13.4%
Criminal Justice	8.3 %
Business	7.4 %
Communications	4.6 %
other	~~[illegible]~~ 27.4%
undecided	4.6 %

4. **Are your Raritan courses this semester primarily**

   94% Daytime 6 % Evening — Week-end

5. **Do you plan to transfer after leaving Raritan?** Yes 84% No 4% Undecided 12%

6. **What kind of occupation do you plan to enter?**

   Arts 10% Business 14% Education 28 %
   Engineering/Science 7% Law 5% Medical/Allied Health 8 %
   Public/Government Service 8 % Technical 1% Undecided 18 %
   other 1%

SECTION II - ACADEMIC INTEGRITY AT RARITAN

7. **How frequently do you think the following occur at Raritan?**

	Never	Very seldom	Seldom	Often	Very often
Plagiarism on written assignments	4%	18 %	39%	33%	6 %
Cheating during tests or examinations	5%	23%	38%	28%	6 %

8. **How often have you seen another student cheat during a test or exam at Raritan?**

   Never 42% Once 11% A few times 36% Several times 8 % Many times 3 %

9. **Have you ever reported another student for cheating?**

   Never 97 % Once 2% A few times 1% Several times — Many times —

PLEASE TURN TO QUESTION 10

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Cozin 7

10. If someone asked you for help during a test or exam, what would you do? (Please check one choice.)

		Friend
1. Give him/her the answer	8%	26%
2. Say nothing but expose your paper so he/she can copy the answer	19%	35%
3. Ignore or turn down the request	56%	27%
4. Express disapproval informally but not report him/her	14%	11%
5. Report him/her to the appropriate authorities	1%	–
6. Other ______	2%	1%

If it were a close friend who asked for help, what would you do? (Provide number from list above.) See above

11. What would you do if you saw a student cheating on a major test or examination. (Please check one choice.)

		Friend
1. Report him/her to the instructor, proctor, or appropriate authority	4%	1%
2. Ask the student to report himself/herself and report them if they fail to do so	2%	2%
3. Express disapproval informally to the student but not report him/her	17%	34%
4. Mention the incident to other students but not report it	20%	6%
5. Ignore the incident	56%	56%
6. Other ______	1%	1%

What would you do if the student you saw cheating were a close friend: (Provide number from list above.) See above

12. How would you rate:

	Very Low	Low	High	Very High
The competitiveness for grades at Raritan?	3%	50%	43%	4%
The pressure you feel for getting good grades?	2%	21%	56%	21%
Severity of penalties for cheating at Raritan?	8%	35%	45%	12%
Chances of getting caught cheating at Raritan?	14%	55%	25%	6%
The average student's understanding of Raritan's policies concerning student cheating?	30%	44%	23%	3%
The faculty's understanding of Raritan's policies concerning student cheating?	7%	23%	54%	16%
The faculty's support of these policies?	5%	32%	47%	16%
The effectiveness of these policies?	13%	43%	34%	10%

PLEASE TURN TO QUESTION 13

13. **Many factors may motivate an individual to do his or her academic work honestly. For each of the following items, please indicate its importance in your decisions to act honestly in your academic work at Raritan.**

	Not Important	Somewhat Important	Fairly Important	Very Important
My personal beliefs	3%	8%	26%	63%
Chance of getting caught	13%	14%	26%	47%
My school's policies on academic integrity	21%	31%	27%	21%
Penalties for cheating at Raritan	18%	20%	28%	34%
Respect for my teachers	11%	14%	33%	42%

14. **Many factors may motivate an individual to cheat or engage in questionable behaviors in his or her academic work on occasion. For each of the following items, please indicate its importance in any decisions you have made to engage in behaviors that might be considered cheating.**

	Not Important	Somewhat Important	Fairly Important	Very Important
The pressure to get good grades	13%	18%	27%	42%
The workload at Raritan	17%	32%	37%	14%
Others do it	73%	14%	10%	3%
Little penalty if caught	39%	36%	18%	7%
Little chance of getting caught	31%	35%	23%	11%
Getting behind in my work	16%	29%	38%	17%
Don't think what I did was wrong	39%	30%	18%	13%

15. **Which of the following measures is most likely to be taken by a professor at Raritan who learns of a student cheating on a major test or examination:** (Please check one choice.)

		Written
1. Probably nothing (easier; don't want to get involved; etc.)	2%	2%
2. Reprimand the student and warn him/her not to do it again	6%	7%
3. Make the student re-take the test or examination	9%	12%
3. Fail the student on the test or examination	58%	45%
4. Fail the student for the course	12%	18%
5. Report the student to the appropriate authority	10%	13%
6. Other (please specify) ____	3%	3%

Using the numbers above, please tell us what action you think a professor would take if he or she caught a student cheating on a major written assignment? See above

PLEASE TURN TO QUESTION 16

16. **Which of the following disciplinary measures is most likely to be taken at Raritan if a student is convicted of cheating on a major test or examination: (Please check one choice.)**

		Test	Written
1.	Reprimand the student and warn him/her not to do it again	1%	–
2.	Make him/her re-take the exam or assignment	3%	5%
3.	Make him/her fail the exam or written assignment	28%	33%
4.	Make him/her fail the course	19%	16%
5.	Put a written warning in file or place on probation	13%	11%
6.	Suspend him/her from school	5%	9%
7.	Expel him/her from school	9%	8%
8.	Other (please specify) ______	<1%	<1%
9.	Don't know	22%	18%

Using the numbers above, please tell us what action you think is most likely to be taken if a student is convicted of cheating on a major written assignment? See above

17. **How strongly do you agree or disagree with the following statements?** (Check one choice on each line.)

	Agree strongly	Agree mildly	Not sure	Disagree mildly	Disagree strongly
Under no circumstances is cheating justified.	46%	26%	13%	12%	3%
Reporting someone for cheating is worse than cheating.	9%	19%	27%	24%	21%
Faculty members at Raritan show little uniformity in handling instances of cheating.	6%	15%	63%	8%	8%
Faculty members do not try very hard to catch cheaters.	8%	29%	42%	16%	5%
Cheating is a serious problem at Raritan.	2%	12%	60%	15%	11%
Honesty is desirable but not as important as classmate loyalty.	4%	24%	19%	32%	21%
I am bothered by the cheating that goes on here.	4%	14%	35%	22%	25%
Cheating is common in American society. It is an acceptable way to get ahead.	5%	21%	8%	18%	48%
The college experience should help students develop standards of personal ethical behavior.	44%	41%	10%	4%	1%
Raritan's judicial process is fair and impartial.	9%	16%	68%	5%	1%
Students at Raritan should be held responsible for monitoring the academic integrity of other students.	5%	13%	18%	26%	38%

PLEASE TURN TO QUESTION 18

18. **We would like to ask you some questions about specific behaviors that some people might consider cheating. Please remember that this survey is completely anonymous and there is no way that anyone can connect you with any of your answers. Please <u>circle one response for each question, using the following scales</u>.**

cheating
or more
...mes

		Since coming to Raritan how often have you engaged in any of the following actions? 1 = Never 2 = Once 3 = A few times 4 = Several times 5 = Many times	Are you likely to get caught if you do this? 1 = Very unlikely 2 = Unlikely 3 = Not sure 4 = Likely 5 = Very likely	Which actions do you consider to be cheating? 1 = Not cheating 2 = Trivial cheating 3 = Serious cheating
%	Copying from another student during a test (or exam) <u>without</u> his or her knowing it.	1 2 3 4 5 1.49	1 2 3 4 5 2.71	1 2 3 2.51
%	Copying from another student during a test <u>with</u> his or her knowledge.	1 2 3 4 5 1.54	1 2 3 4 5 2.78	1 2 3 2.49
1%	Using unpermitted crib notes (or cheat sheet) during a test.	1 2 3 4 5 1.43	1 2 3 4 5 2.97	1 2 3 2.58
%	Getting questions or answers from someone who has already taken a test.	1 2 3 4 5 1.77	1 2 3 4 5 2.18	1 2 3 2.18
7%	Helping someone else cheat on a test.	1 2 3 4 5 1.68	1 2 3 4 5 2.82	1 2 3 2.34
3%	Cheating on a test in any other way.	1 2 3 4 5 1.40	1 2 3 4 5 2.84	1 2 3 2.41
%	Seen another student cheating on a test.	1 2 3 4 5 2.34		
%	Copying material, almost word for word, from any source and turning it in as your own work.	1 2 3 4 5 1.49	1 2 3 4 5 3.25	1 2 3 2.54
1%	Fabricating or falsifying a bibliography.	1 2 3 4 5 1.54	1 2 3 4 5 3.01	1 2 3 2.32
3%	Turning in work done by someone else.	1 2 3 4 5 1.23	1 2 3 4 5 2.96	1 2 3 2.63
5%	Receiving substantial, unpermitted help on an assignment.	1 2 3 4 5 1.42	1 2 3 4 5 2.45	1 2 3 1.97
8%	Working on an assignment with others when the instructor asked for individual work.	1 2 3 4 5 1.69	1 2 3 4 5 2.37	1 2 3 1.83
5%	Copying a few sentences of material without footnoting them in a paper.	1 2 3 4 5 2.04	1 2 3 4 5 2.67	1 2 3 2.11
%	Writing or providing a paper for another student.	1 2 3 4 5 1.29	1 2 3 4 5 2.70	1 2 3 2.50
3%	In a course requiring computer work, copying a friend's program rather than doing your own.	1 2 3 4 5 1.31	1 2 3 4 5 2.75	1 2 3 2.48
8%	Falsifying lab or research data.	1 2 3 4 5 1.32	1 2 3 4 5 2.99	1 2 3 2.37

PLEASE TURN TO QUESTION 19

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19. **How likely is it that:**

	Very Unlikely	Unlikely	Likely	Very Likely
you would report an incident of cheating that you observed?	64%	31%	5%	<1 %
the typical student at Raritan would report such violations?	50%	44%	6%	<1 %
a student would report a close friend?	88%	10%	1%	<1 %

SECTION III - PERSONAL DATA

20. **Please provide the following information about yourself. It will be used to help us analyze the overall results of this survey. We remind you that all individual information is completely anonymous.**

Are you: Female 64% Male 36 %

What is your estimated GPA or grade point average? 2.95

21. **When you were in high school how often:**

	Never	Once	A few times	Several times	Many times
Did the typical student cheat on a major written assignment	4%	9%	44%	28%	15%
Did you cheat on a major written assignment in any way	39%	12%	34%	11%	4%
Did the typical student cheat on a test or exam	4%	9%	39%	28%	20%
Did you cheat on a test or exam	29%	14%	39%	13%	5%

22. **What was your grade average in high school:** (Please circle your answer below.)

A A- B+ B B- C+ C C- D+ or lower Mean = 4.41

23. **How does the level of test/exam cheating at Raritan compare to the level of cheating at your high school:**

Much higher in high school 29% Higher in high school 37% About the same 22%

Lower in high school 8% Much lower in high school 4%

24. **Please use this space for any comments you care to make or if there is any thing else you would like to tell us about the topic of cheating in college.**

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THANK YOU VERY MUCH FOR YOUR ASSISTANCE.

RARITAN VALLEY COMMUNITY COLLEGE
ACADEMIC INTEGRITY SURVEY
FACULTY RESPONSE

How many years have you taught at Raritan?

19% 1-5
17% 6-10
14% 11-15
14% 16-20
36% 21+

Which department are you in?

____

How frequently do you think the following occur at Raritan?

	Never	Very seldom	Seldom	Often	Very often
Plagiarism on written assignments	0%	17%	25%	53%	6%
Cheating during tests or examinations	0%	34%	51%	14%	0%

4. How often have you seen a student cheat during a test or exam at Raritan?

Never 25% Once 16% A few times 43% Several times 17% Many times 0%

5. Have you ever reported a student for cheating?

Never 46% Once 17% A few times 23% Several times 14% Many times 0%

Cozin 13

6. **How would you rate:**

	Very Low	Low	High	Very High
The competitiveness for grades at Raritan?	6%	53%	32%	6%
The pressure students feel for getting good grades?	3%	38%	47%	9%
Severity of penalties for cheating at Raritan?	14%	57%	26%	0%
Chances of getting caught cheating at Raritan?	13%	53%	34%	0%
The average student's understanding of Raritan's policies concerning student cheating?	39%	44%	17%	0%
The faculty's understanding of Raritan's policies concerning student cheating?	9%	50%	41%	0%
The faculty's support of these policies?	9%	42%	45%	3%
The effectiveness of these policies?	6%	58%	35%	0%

7. **Which of the following measures is most likely to be taken by a professor at Raritan who learns of a student cheating on a major test or examination:** (Please check one choice.)

1. Probably nothing (easier; don't want to get involved; etc.)	2%	6%
2. Reprimand the student and warn him/her not to do it again	17%	6%
3. Make the student re-take the test or examination	7%	15%
4. Fail the student on the test or examination	50%	39%
5. Fail the student for the course	7%	9%
6. Report the student to the appropriate authority	17%	18%
7. Other (please specify) ______		

Using the numbers above, please tell us what action you think a professor would take if he or she caught a student cheating on a major written assignment? ____

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Cozin 14

8. **How strongly do you agree or disagree with the following statements?** (Check one choice on each line.)

	Agree strongly	Agree mildly	Not sure	Disagree mildly	Disagree strongly
Under no circumstances is cheating justified.	97%	0%	3%	0%	0%
Reporting someone for cheating is worse than cheating.	0%	6%	3%	3%	88%
Faculty members at Raritan show little uniformity in handling instances of cheating.	14%	26%	60%	0%	0%
Faculty members do not try very hard to catch cheaters.	3%	19%	53%	16%	8%
Cheating is a serious problem at Raritan.	6%	6%	53%	26%	9%
Honesty is desirable but not as important as classmate loyalty.	0%	3%	0%	12%	84%
I am bothered by the cheating that goes on here.	10%	23%	26%	23%	19%
Cheating is an acceptable way to get ahead in American society.	6%	11%	3%	11%	69%
The college experience should help students develop standards of personal ethical behavior.	83%	14%	0%	0%	3%
Raritan's judicial process is fair and impartial.	21%	32%	44%	3%	0%
Students at Raritan should be held responsible for monitoring the academic integrity of other students.	12%	35%	26%	12%	15%

9. **How often have you seen a student cheat during a test or exam at Raritan?**

Never 18% Once 24% A few times 48% Several times 9% Many times 0%

10. **Are you familiar with the college policy on cheating, plagiarism and behaviors which violate academic integrity?**

6% no
81% yes
23% sort of

11. **On occasions when you observed cheating on an exam, what have you done?**

28% Followed college policy on student cheating
23% Expressed disapproval informally to the student
44% Gave student a failing grade on exam
3% Ignored the incident
3% Other –please describe below

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Cozin 15

12. On occasions when you followed official college procedures and reported a student for cheating or plagiarism how was it resolved and were you pleased with the resolution

____

____

____

13. Compared to area high schools, students at Raritan are

28% less likely to cheat and plagiarize

6% more likely to cheat and plagiarize

66% cheat and plagiarize about the same amount

14. What do you do, if anything, to reduce cheating and plagiarism in your classes?

____

____

____

____

In the space below please elaborate or comment on any of the above questions or on other issues regarding cheating/academic integrity at R.V.C.C.

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Cozin 16

References

McCabe, Donald L., and Trevino, Linda K. "What We Know About Cheating In College". Change (January/February 1996) 29-33.

Acknowledgement

The author wishes to acknowledge the assistance provided by Professor Donald L. McCabe. Professor McCabe generously allowed the use of his questionnaire as well as providing (in a personal communication) summary data from non-honor code four year colleges.

1998-1999 Fellows
Princeton University/New Jersey Community Colleges Partnership
Mid-Career Fellowship Program

Instructional Technology and Faculty Development

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Instructional Technology and Faculty Development

With the arrival of the new millennium, the community college has many challenges and opportunities to face. Community colleges are "rushing toward a future where access to information and the power to manipulate it will give learners options they have never known, instructors capabilities the likes of which they have never dreamed, and leaders tools for decision making that exceed any expectations." (Milliron) The use of information technology across community college campuses has risen dramatically over the last ten years. K.C. Green's *1996 Annual Campus Computing Survey* stated that infusing information technology into instruction has become one of the top two technology issues facing all of higher education. Instructional technology holds the potential for dramatic change and remains a critical challenge at the community college.

Instructional Technology Trends.

Technology provides numerous choices in today's community college classroom. Instructors can offer a wide array of learning possibilities, which include the following:

• Telecourses	• Tele-Web courses
• ITV	• Online classes
• Presentational technologies	• Internet
• Web searches	• Computer-based multimedia training
• E-mail and listserv collaboration	• Threaded discussions
• Bulletin-board services	• Online chat rooms and net meetings
• Simulators	• Online tutorials

Challenges of Instructional Technology.

Although instructional technology has the potential for dramatic change, integrating these new teaching/learning techniques still present a serious challenge to the faculty and the administration. In the average classroom, instructors traditionally lecture to their students about 80 percent of the time and the students are listening to what is being said about 50 percent of the time. (Stetson, 1993) Marilyn Gilroy comments that many faculty are struggling to effectively deliver the traditional lecture and find it almost impossible to maintain students' attention for more than 20 minutes. (Gilroy, 1998) "Students who grow up in a technological age will not accept lectures that fail to draw upon the information resources on the Internet and elsewhere." (Alvarez, 1996)

A second challenge facing the community college in integrating technology is the faculty debate that the use of technology will "dehumanize teaching and learning." (Burke, 1994) According to Burke, technology can personalize the student's education because it can be tailored to the individual needs and learning style of each person. (1994) When instructors add technology-supported learning options, the ability to accommodate style variations is expanded. (Smith, 1997) If technology is used correctly by the instructor, the opportunity for human interaction should increase with the result being just the reverse of dehumanization.

Community college professors often criticize that technology will "reduce their role in teaching." (Burke, 1994) On the contrary, Burke feels that faculty will have more time to mentor students, to deal with individual differences, and to reach higher levels of knowledge and wisdom. (1994)

Finally, faculty feel that technology is a tool which will decrease their number and salary. Community college faculty argue that instructional technology diminishes the importance of the traditional lecture. In an opposing viewpoint, Burke states that faculty will use their time on higher order contributions such as advising, counseling, mentoring and collaborating and that faculty compensation will no longer be measured by a time clock. (1994)

Anticipating the Future.

Integrating this rapidly changing, innovative instructional technology requires long-range planning with a vision toward the future. Since one of the missions of the community college is to prepare its students with the skills, aptitudes, and knowledge needed to interface with the coming technology, educators must anticipate the workplace and society of the future. According to Daggett, the community college instructor must expose students to technology and create a curriculum which prepares the students for their technological future. (1998) However, "the problem schools face today in preparing these students for their technological future lies in limited and/or inadequate staff development." (Poole, 1998)

> If staff development is really the key to integration, then why are computers collecting dust when many teachers have already been sent to technology workshops? One-shot workshops, added expense of training, lack of continued support, isolated knowledge, unawareness of school needs, lack of knowledge and support from leadership all contribute to the ineffectiveness of technology staff development." (Poole, 1998)

County College of Morris and Faculty Development

A ***Technology Plan for County College of Morris*** (CCM), developed in 1997, included the creation of an Information Technology Committee. The committee was charged with the following action items: technology bond, student access, faculty development, distance learning, facilities retrofitting, technical support, and a help line. As the Director of the Center for Teaching Excellence, I was responsible for the Faculty Development Action Team of the Information Technology Committee.

Once CCM had its technology plan in place and the hardware and software was ordered, the next big question came: "How do we create an environment in which our faculty and staff use the technology effectively in the teaching and learning process?" (Zeiss, 1998) Initially, a faculty technology skill survey was distributed to determine the technology skill levels of our full-time and adjunct faculty..(*See Appendix A*) The results of this survey were used to determine the training needed to develop faculty skill in the use of technology to enhance teaching, learning, scholarship, and instructional delivery. Specific training needs were addressed through the In-House Training Program offered in the spring and fall semesters. Technology courses were offered in the Microsoft Office software suite, videoconferencing software, web page design, electronic mail, Java, Microsoft Windows NT, 95 and 98, basic HTML, Internet searches, Microsoft FrontPage and Adobe Photoshop and PageMaker software.

Providing the vision and leadership in the area of staff development is the sole responsibility of the Director of the Center for Teaching Excellence (CTE) at County College of Morris. When I assumed the Director's position in January 1997, the college administration asked me to increase the technology offerings to our faculty and staff. "The whole issue of staff development is becoming quite a challenge. Training people is the easy part; getting them to buy into new technology is quite another." (Zeiss, 1998) As Schroeder states in his article, "The $2,500 Paperweight," so many in higher education have failed to recognize that hardware, without the accompanying knowledge of how to use it, is a terrible waste of money and potential. "To the extent we fail to provide training, we will most certainly fail to reach the potential of our precious investment in technology." (Schroeder, 1997) At County College of Morris, the administration made a commitment to put a computer with an Internet connection on every faculty member's desk and to support the faculty instructional technology training needs. If the faculty did not buy into this technology training, these new multimedia computers might become pretty expensive paperweights!

CCM's Faculty Development Model

Supporting faculty development in instructional technology and providing opportunities to discover how the use of technology could enhance the teaching/learning environment required CCM to find a new faculty development model. Existing methods used to train faculty included the CTE In-House Training Program and Professional Day Workshops at the beginning and end of each semester. With the approval of the Technology Plan and the implementation of the technology purchases, several new issues developed that required immediate attention and training. These included electronic mail systems for faculty and students, an upgrade to the college records and registration system, course management tools for online courses, upgrading personal computers, installing new software versions, redesigning lecture halls into electronic multimedia presentation rooms, and installing a new ATM backbone for the college infrastructure. What training model should CCM adopt in order to get the cautious professors to participate and take advantage of the instructional technology training?

The Dean of Professional Programs and Distance Education led the way with her vision for a Teaching/Learning Technology Center, an Instructional Design Team, and the selection and implementation of WebCT as our online course management tool. The Director of the CTE was involved in every aspect of this faculty development model. First, the newly formed **Teaching/Learning Technology Center** was created and housed in our Learning Resource Center. It was outfitted with seven high-end multimedia personal computers, color inkjet printers, scanners, assorted software, and digital cameras. Second, an **Instructional Design Team** was established with a team leader who was a faculty member from the English Department and four representatives from each of our academic divisions. The Instructional Design Team members motivated each other and made themselves accessible to our faculty in the Teaching/Learning Technology Center. The Team members learned from each other and became our resident technology experts and pioneers. Finally, with the anticipated online course offerings in the fall 1998 semester, serious efforts were made in spring 1998 to select a course management tool. Team members, along with the CTE Director and the Dean of Distance Education, reviewed and tested several software products before selecting **WebCT** as CCM's online course management tool.

Center for Teaching Excellence Initiatives. In the spring of 1997, CTE sponsored a professional day guest lecturer, Dr. Stephen Ehrmann of the American Association of Higher Education; and this encouraged the Instructional Design Team to participate in a Teaching/Learning Technology Round Table Conference, which was sponsored by AAHE. The result of this conference was the framework for the Information Technology Committee's Action Teams that were mentioned earlier in this report. Several PBS live satellite teleconferences were offered at CCM as faculty development sessions—Putting Your Course Online, Developing for the World Wide Web, and Internet Copyright Issues. The Center for Teaching Excellence piloted a PBS Internet Literacy online course in the spring 1998. Over 27 individuals from the campus community—including faculty, administrators, and even Board of Trustee members—subscribed to this pilot online course. All participants had an opportunity to experience first-hand what is really involved in taking an online course at a community college.

In the spring of 1999, a special professional development opportunity was offered to all full-time and adjunct faculty at the college. ***How To Put Your Course Online—A Ten-Step Training Program*** has been extremely well received by the faculty. (*See Appendix B*) Each of the ten one-hour sessions is held at the Teaching/Learning Technology Center with several of the Instructional Design Team members and the CTE Director providing the training in the following content areas:

1. What's different about distance teaching?
2. Organizing your course content.
3. WebCT Basics
4. Getting your course content ready for WebCT.
5. Posting your course on WebCT.
6. Using Forums/Bulletin Boards in WebCT.
7. Creating Quizzes in WebCT.
8. Using Other WebCT Tools.
9. Adding audio to WebCT.
10. Adding video to WebCT.

After completing the ten-step training program, it is hoped that the faculty participants will be proficient in using the technology to deliver or supplement their course material. To facilitate the next phase of their project development, CTE is proposing a Faculty Summer Institute for the summer of 1999. Entry into this institute will be on a competitive basis and each person enrolled will be awarded a stipend. The goal of the institute is to provide the faculty with the time, hardware, software, and expertise needed to complete a scholarly technology project of their choosing.

Lessons Learned.

Did County College of Morris use an existing faculty development model to enhance the teaching/learning environment? After some informal campus interviews, I am of the opinion that a hybrid of many staff development models was used at CCM. Institutions such as Maricopa, Houston, Dallas, Kansas City, Johnson Community College in Kansas City, and DeAnza provided the models for CCM's hybrid faculty development initiatives. Many of these strategies were discovered at several League for Innovation conferences.

The County College of Morris faculty development model applies many of the staff development principles that have been successfully implemented in other models. The T-4 Plan Model (Poole, 1998) is "built on the premise that technology training can support a school's advancement toward technology integration using a team effort." Other T-4 Plan Model goals include:

- Providing release time for staff to work with technology to become more efficient in using it personally and professionally *(CCM's design team receives release time.)*
- Demonstrating how technology can be integrated into the learning process
- Creating an awareness of technological innovations and their possibilities
- Establishing a collaborative teaching atmosphere by using the teacher-to-teacher training model

CCM's Instructional Design Team clearly supports this principle through the sharing of information from professor to professor.

In the Cross and Angelo Classroom Research Model (Stetson, 1993) recommendations for a successful program based on five years' experience in providing training in the use of Classroom Assessment Techniques include the following:

1. Plan carefully and plan for the long term.
2. Offer systemic and substantive training over a period of at least one semester. One-day workshops will not result in changed behavior.
3. In designing the training, use what is already known about good teaching and learning. Proven principles include frequent trainer contact with the faculty; prompt feedback from the trainer to faculty; use of cooperative and active learning strategies; encouragement of faculty; use of a variety of teaching methods; clear expectations about what the faculty are to learn; and the use of an enthusiastic and expert trainer.

4. Provide ongoing support for individuals and groups, for example, one-on-one consultations with the staff development officer, monthly meetings of participants, and "study buddies."
5. Use faculty participants as recruiters for the program. They can make presentations to groups during staff development days or recruit one on one.
6. Offer incentives, both tangibles and intangibles, to those who participate fully, including stipends, food, pleasant working environment, opportunities for presentations, encouragement for publications, and other support.
7. Last, but not least, make faculty participation in the program voluntary and nonthreatening. (Stetson, 1993)

The selected principles in use at CCM include: voluntary and nonthreatening faculty participation, ongoing support, tangible and intangible incentives, systemic and substantive training, and excellent teaching and learning principles demonstrated by enthusiastic instructors.

At DeAnza College in California, they decided to offer small incentive grants to instructors to develop Web courses. DeAnza decided to spend $50,000 on the faculty and allowed them to design and develop their own courses rather than using a template or course authoring system. Training was provided in adapting existing courses for an online presentation format. Topics included the following:

- Understanding distance learning methodology
- Organizing content into a logical flow
- Building a flow chart of the course
- Creating resource links
- Developing a storyboard
- Managing resources
- Getting all the parts together
- Site testing
- Editing and quality assurance online (Acebo, 1998)

When compared to CCM's **How To Put Your Course Online—A Ten-Step Training Program**, many similarities can be seen. However, the research on DeAnza College was not done beforehand; and, therefore, it was not used in the development of the CCM hybrid model. Upon comparison afterwards, the DeAnza training model parallels the CCM faculty development model in many areas.

Summary.

Although there is no conclusive, widespread evidence in the research literature that the use of instructional technology improves student learning, community colleges are at a risk of falling behind in technology and in preparing today's students with the skills and knowledge needed to cross into the millennium. Further research must explore connections between the use of technology for instruction and effective learning. (Taber, 1998)

In conclusion, providing the proper type of staff development training in instructional technology will have a positive effect at the community college. In reality, there is no "one-size fits all" training model for all institutions. Each institution must select what works best for its faculty and this can be determined by surveying them. Using interested faculty members as recruiters, mentors and trainers provides the foundation for a comfortable professional development environment. Faculty support is a critical element to the success of any staff development program—without it, your program cannot succeed.

County College of Morris
Faculty Technology Skill Survey

This survey will help determine the training needed to develop faculty skill in the use of technology. This is important to assure that faculty can make use of technology to enhance teaching, learning, scholarship, and instructional delivery.

1. Do you use a personal computer in your office? Yes☐ No☐

   If **yes**, how frequently do you use it?
   ☐ Daily ☐ Weekly ☐ Monthly ☐ Less often

   if **yes**, tell us about your computer:
   Type of Workstation
   ☐ DOS
   ☐ Windows 3.1
   ☐ Windows 95
   ☐ Macintosh
   ☐ Other (please specify) ______________________

   Do you have a CD-ROM drive? ☐Yes ☐No
   Is your computer connected to CCMNet? ☐ Yes ☐ No
   Does your computer have a sound card & speakers? ☐ Yes ☐ No

2. Do you use a personal computer at home? ☐ Yes ☐No

   If **yes**, what type of workstation is your computer?
   ☐DOS ☐Windows 3.1 ☐Windows 95 ☐ Macintosh

   If **yes**, do you connect to campus from home? ☐Yes ☐ No

3. Please rate your skill level for the following uses of technology:

Skill	Don't Use	Beginner	Intermediate	Expert
• Word processing				
• Spreadsheet software				
• Authoring software				
• Electronic mail				
• Newsgroups				
• World Wide Web				
• Remote access to library databases				
• Listservs				
• Online searches				
• Presentation software				
• Interactive multimedia software				
• Collaborative software				
• Network distribution of class materials				
• Computer conferencing software				

Continued...

4. Please tell us what discipline- or course-specific software you use.

5. What do you need in the following areas to help you do your job better?

- **Software**
- **Hardware**
- **Training**
- **Other**

6. Please tell us of any issues or ideas you may have regarding the use of technology at CCM.

7. ***Adjunct Faculty Only***: When would be the best time for CCM to provide training?

Would you participate in the training? ☐ Yes ☐ No

8. Would you be interested in participating in the **Center for Teaching Excellence Technology Partners Project**? This project would match expert faculty technology users with beginner faculty technology users. ☐ Yes ☐ No

Name:
Department:
Mail Station:
E-Mail Address:
Phone No.:

Thank you for completing the survey!
Return by December 23, 1997, to Carole A. Holden, Director
Center for Teaching Excellence
HH114

Faculty Technology Skill Survey Results—January 1998

95 Surveys returned by full-time and adjunct faculty members

1. Do you use a personal computer in your office? 74 Yes 8 No
   If yes, how frequently do you use it?
   62 Daily 13 Weekly 3 Monthly 4 Less often
   If yes, tell us about your computer:
   Type of workstation:
   - 3 DOS
   - 13 Windows 3.1
   - 48 Windows 95
   - 6 Macintosh
   - 5 Other

   Do you have a CD-ROM drive? 42 Yes 34 No
   Is your computer connected to CCMNet? 43 Yes 30 No
   Does your computer have a sound card & speakers? 32 Yes 42 No
2. Do you use a personal computer at home? 82 Yes 12 No
   If yes, what type of workstation is your computer?
   - 8 DOS
   - 18 Windows 3.1
   - 48 Windows 95
   - 11 Macintosh

   If yes, do you connect to campus from home? 19 Yes 61 No

Skill	Don't Use	Beginner	Intermediate	Expert
Word processing	8	13	52	22
Spreadsheet software	38	20	26	11
Authoring software	73	10	9	2
Electronic mail	15	26	4	13
Newsgroups	69	16	7	3
World Wide Web	19	33	32	11
Remote access to library databases	62	19	11	3
Listservs	66	20	9	0
Online searches	40	22	22	11
Presentation software	49	23	15	8
Interactive multimedia software	61	20	6	8
Collaborative software	79	10	5	1
Network distribution of class materials	79	12	3	1
Computer conferencing software	85	7	3	0

How to Put Your Course Online

Learn to use new technology to deliver or supplement your course material. The process has been divided into ten easy steps. Register for one or more of the ten modules. Complete all ten steps and earn a certificate of recognition in ***Teaching/ Learning Technology***.

Step 1: What's different about distance teaching?

- ■ Transform traditional classroom content to an online environment
- ■ Identify distance education students
- A. Wednesday. February 10. 2:30-3:30 p.m.. LRC 110
- B. Friday. February 12. 10-11 a.m.. LRC 110

Step 2: Organizing your course content.

- ■ Outlining or storyboarding
- ■ Visualizing how your class will be used
- ■ Meeting student needs
- A. Wednesday. February 17. 2:30-3:30 p.m.. LRC 110
- B. Friday. February 19. 10-11 a.m.. LRC 110

Step 3: WebCT Basics

- ■ Learn how this course management tool works **http://www.webct.com/webct/**
- ■ Explore the calendar tool
- A. Wednesday, February 24, 2:30-3:30 p.m. LRC 110
- B. Friday. February 26, 10-11 a.m.. LRC 110

Step 4: Getting your course content ready for WebCT

Note: ***Participants should bring 4-5 paragraphs of typed course material saved on a disk.***

- ■ Learn to use Netscape Composer in 8 minutes or less
- ■ Find free graphics on the Internet
- ■ Learn how to use tables to organize your content
- A. Wednesday. March 3, 2:30-3:30 p.m. LRC 110
- B. Friday. March 5. 10-11 a.m.. LRC 110

Step 5: Posting your course on WebCT

Note: ***Participants should bring their disk from Step 4.***

- ■ Learn to use File Manager on Web CT
- A. Wednesday, March 10, 2:30-3:30 p.m, LRC 110
- B. Friday, March 12. 10-11 a.m., LRC 110

Step 6: Using Forums/Bulletin Boards in WebCT

- ■ Discover this major mechanism for student/student and student/ faculty interaction
- A. Wednesday, March 24, 2:30-3:30 p.m, LRC 110
- B. Friday, March 26, 10-11 a.m., LRC 110

Step 7: Creating Quizzes in WebCT

Note: ***Participants should bring some sample quiz material.***

- ■ Learn how to create quizzes in WebCT
- A. Wednesday, April 7, 2:30-3:30 p.m, LRC 110
- B. Friday, April 9. 10-11 a.m., LRC 110

Step 8: Using Other WebCT Tools

- ■ Private Mail
- ■ Student Tracking
- ■ Student Grade Records
- ■ Student Home Pages
- ■ Glossary
- A. Wednesday, April 14. 2:30-3:30 p.m, LRC 110
- B. Friday, April 16, 10-11 a.m., LRC 110

Step 9: Adding Audio to WebCT

- ■ Use Real Audio to create and upload sound
- A. Wednesday, April 21. 2:30-3:30 p.m. LRC 110
- B. Friday. April 23. 10-11 a.m.. LRC 110

Step 10: Adding Video to WebCT

- ■ Discover how to add video to your online course
- A. Wednesday. April 28. 2:30-3:30 p.m. LRC 110
- B. Friday, April 30. 10-11 a.m.. LRC 110

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Use of the Internet

in Teaching Mathematics

in the Community College

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Use of the Internet in Teaching Mathematics in the Community College

One of the most rapidly growing areas in higher education today is the use of the Internet as a supportive technology for the classroom. The Internet is used in many ways. Faculty instruct students to "surf the net" in search of information, data, and project ideas. Students use E-mail and chatrooms to communicate with faculty and other students. Faculty members use web sites to give assignments, post lecture notes, etc. In a rapidly expanding number of cases, college courses are being offered in a distance learning mode, or "on-line," over the Internet. Robert Moskowitz in his article, "Wired U.," sees this latter use as a major "revolution happening in education."[1]

With this rapid growth in the use of electronic technology comes many questions. Robert Jacobson has raised a number of questions in his Chronicle of Higher Education article, "Extending the Reach of 'Virtual' Classrooms."[2] Are we compromising the quality of education in our attempt to do more with less? Will answering endless E-mails from students increase the faculty workload? Will electronic classrooms eventually replace many professors? Will students lose out on social interaction and related social skills? There are a lot of questions and very few answers. This study focuses on one narrow segment of this revolution, the utilization of the Internet in community college mathematics courses.

There are two components to this study. The investigator's primary interest is in community college mathematics programs in New Jersey. Thus, the first component considers the general use of the Internet by the mathematics departments in New Jersey's nineteen community colleges. The second component moves to the national level. At this level the focus is on the use of the Internet to offer on-line mathematics courses rather than on the general use of the net. The goals of this component were to see how New Jersey compared to the nation in this area and to get input from mathematics faculty members who already offer on-line courses.

Use of the Internet in New Jersey's Community Colleges

During the 1999 Spring Semester, questionnaires were sent to representatives from each of the mathematics departments in New Jersey's nineteen community colleges. (A copy of the questionnaire is in Appendix A.) Sixteen questionnaires (84%) were returned. The responses represented every part of the state and the various sizes of community colleges in New Jersey. Of the sixteen department representatives who responded, eight (50%) indicated that their departments do not currently use the net in

1. Moskowitz, Robert, "Wired U.", Internet World, October 1995, pg. 60.
2. Jacobson, Robert, "Extending the Reach of 'Virtual' Classrooms", The Chronicle of Higher Education, July 6, 1994, pp. A19 - A21.

any way. Four of the eight indicated that their departments planned to use the web in some way during the academic year 1999 - 2000. Three of these stated that they planned to offer at least one course on-line.

The list below indicates the reasons, in the order of frequency, given by the eight respondents for not currently using the Web.

- 4 Lack of adequate hardware
- 3 Lack of adequate funding
- 3 Still getting connected to the Web
- 3 Lack of adequate training for faculty
- 2 Lack of adequate support for the idea within the department
  (One respondent specifically indicated that despite administrative support and the availability of hardware and training the faculty lacked adequate interest.)
- 2 Lack of adequate support from the administration

The lack of hardware or connection to the Web is not symptomatic of two-year colleges in New Jersey only. The researcher discovered that even though most two-year colleges nationwide have web sites, the majority of mathematics faculty are still not on-line.

The other eight respondents indicated that their departments used the Web in some way in at least one course. All eight also indicated that only a few members of their departments were involved in using the Internet for their courses. One respondent indicated that she was the only member of the department using the Web. Another stated that only three or four members out of twenty-three used the Web. Again as indicated above, the investigator found that this was true in other states as well.

The respondents indicated the Internet was used in the following courses and in the following ways.

# of colleges	Course	S M	C R	Use AP	E M	Full
5	Basic Skills	2	1	3	3	-
2	College Algebra	-	-	-	1	1
2	Liberal Arts Math	-	-	2	1	-
1	Math Concepts	1	-	-	-	-
1	Topics	-	-	1	-	-
5	Statistics	-	-	1	4	1
3	Precalculus	1	-	2	3	-
6	Calculus	3	1	3	4	-
2	Linear Algebra	1	-	1	2	-
2	Differential Eq.	-	-	-	2	-

S M - support material such as syllabi, class notes, assignments etc. are given on the net
C R - chatroom is provided for the students to discuss their work with each other
AP - the net is used as a resource for applications and / or research topics
E M - E-mail is utilized as a communication link between faculty and students
Full - the complete course is offered in "distance learning" mode on the net.

Only one of the colleges currently offers on-line courses - College Algebra and Statistics. Five respondents indicated their colleges would have on-line mathematics courses in the 1999 - 2000 academic year. This included the one currently having an on-line course, the three previously mentioned that currently do not use the Web at all, and one that currently uses the Web in a limited way.

At this point, E-mail seems to be the most popular application of the Internet. Several respondents commented about its use. They indicated that the students like having easy "access twenty-four hours a day, seven days a week." They also liked the idea of "immediate feedback" and the quick exchange of information. One faculty member felt closer to her students because of the E-mail exchanges. One respondent indicated that her college provides E-mail addresses for all full-time and part-time faculty and for students who desire them. However, it is up to the instructors to decide if they want to use it in their courses. It is quite interesting that compared with the relatively high use of E-mail, almost no one uses the chatroom capabilities of the Internet. One major drawback of the chatroom is scheduling. Community college students follow a wide range of schedules. It is very difficult to find a time when most or all of the class will be on line at the same time. To schedule such a time would eliminate the touted web advantage of flexibility.

The next most popular application of the Internet is as a source of information, current data, and project ideas. One respondent stated that "the on-line research component of my Calculus I class has increased the amount of student communication about mathematics and encouraged them to explore connections between calculus and other disciplines." Two other respondents said that current information made projects more meaningful and interesting for the students.

One respondent indicated that the students in her Internet class were more motivated and worked at a "higher quality" level than those in her other classes. This respondent also indicated that this class takes much more preparation time, even though it is a net enhanced course and not an on-line course. She indicated in an interview that she spends about three hours a day developing and enhancing her site and responding to E-mail. Although the time factor was not a problem for her, it was for another respondent.

On-Line Mathematics Courses on the National Level

The investigator visited the web sites of 774 two-year colleges across the United states. These sites were selected from a list of colleges in a site provided by the University of Texas at Austin (utexas.edu/world/comcol). Of these, 264 (34%) offered on-line courses. Only 76 (10%) of these colleges currently offered mathematics courses on-line or had on-line math courses listed for the summer or fall 1999 semesters. It might be noted that this is a much lower proportion than New Jersey's projected 26% for the fall semester.

A questionnaire was E-mailed to twenty-five mathematics faculty members listed as currently teaching on-line courses. (A copy of the questionnaire is in Appendix B.) These faculty members were from community colleges representing thirteen states. Only five questionnaires were returned. The respondents were from Illinois, Massachusetts, Nevada, Tennessee, and Texas. The researcher found it intriguing that only 20% of the E-mailed questionnaires were returned versus the 84% in the mailed form done in New Jersey. The results may be related to the fact that the researcher is known by many of the respondents in New Jersey and not by those on the national level. However, the question still lingers as to whether the format, E-mail vs. paper mail, played a role. If it did play a role, it could have implications for courses taught on the Web.

The following information is based on the five responses mentioned above plus the response from the earlier survey received from a New Jersey college which currently offers on-line mathematics courses. Five of the six respondents said that only a few members of their math departments used the net to support their courses. One indicated that about half of his department used the net. The respondents indicated the Internet was used in the following courses and in the following ways.

				Use		
# of colleges	**Course**	**S M**	**C R**	**AP**	**E M**	**Full**
5	Basic Skills	2	1	1	2	2
3	College Algebra	2	2	2	2	3
1	Finite Math	1	1	1	1	1
1	Liberal Arts Math	1	1	1	1	1
1	Contemporary Math 1	-	-	1	1	-
1	Contemporary Math 2	-	-	1	1	-
1	Math for Elem. Teach	-	-	1	1	-
3	Statistics	-	-	1	2	1
4	Precalculus	2	1	1	2	1
5	Calculus	3	2	2	4	2
1	Linear Algebra	-	-	-	-	1
2	Differential Eq.	-	-	-	1	1

S M - support material such as syllabi, class notes, assignments etc. are given on the net
C R - chatroom is provided for the students to discuss their work with each other
AP - the net is used as a resource for applications and / or research topics
E M - E-mail is utilized as a communication link between faculty and students
Full - the complete course is offered in "distance learning" mode on the net.

As with the New Jersey study, E-mail was the most popular application of the Internet. However, there was an increased use of the chatroom facility with this group that offered on-line courses. Again, using the net as a resource for applications and / or research topics was also important.

All six respondents indicated that the Internet sections used basically the same syllabus as the non-Internet sections. However, two indicated that they were not taught at the same level. They did not indicate whether they considered the Internet level to be higher or lower. One indicated that a CD ROM and extra files created by the instructor were used with the Internet sections. The second respondent indicated that the Internet students had on-line materials in addition to the text and would only see the instructor when they had problems. Two of the six respondents indicated that the Internet sections had a lower retention rate than the standard sections. One of these indicated a drastic difference for College Algebra sections: 60% retention for the lecture format vs. 25% for the Internet format. A third respondent also indicated differences in retention, but noted that it varied by course. In this case the Internet section of Liberal Arts Math had a higher retention rate than the standard format while the Internet Differential Equations sections had a lower retention rate.

When asked what they considered an appropriate cap on enrollment for an Internet section, half of the respondents indicated a maximum of twenty students. One said twenty-five, another thirty-five, and a third said twelve. Based on conversations with people teaching on-line courses, the problem with larger sections is communications. Reading and responding to E-mail is very time consuming. This may turn out to be a problem for students as well as faculty if the students E-mail each other. Chatrooms have even greater problems with larger groups. A group larger than twenty or twenty -five students can lead to utter chaos in a chatroom. When asked what upper limit their colleges placed on Internet sections, four respondents gave numbers between thirty and thirty-five. One respondent said fifteen. The sixth said the current limit is forty-five, but it is being reduced to twenty-four. It seems that most colleges, if this sample is representative, do not yet recognize the unique problems for Internet sections.

None of the six colleges represented used screening devices to determine whether students are suitable candidates to successfully take an on-line course. The researcher noted as he visited the various college web sites that some colleges state that certain types of students are more suited for on-line courses, or distance learning courses in general, than others. They provided self-evaluation tests to help students determine whether or not they should attempt an on-line course or a distance learning course. The researcher believes that the use of such self-evaluation tools will become more prevalent as colleges become more aware of the unique characteristics of on-line courses and the special personal traits needed to be successful in taking such courses.

The respondents were asked if they, as faculty members, had encountered any major problems in offering math courses over the net. The primary problem seemed to be time. As one respondent put it, colleges don't appreciate "the fact that teaching the course over the net takes at least twice as much time as teaching it in a regular lecture situation." Another respondent suggested that on-line courses take much more time to develop and faculty should be given 3+ hours release time for on-line course development. One respondent stated that the frustration of the increased work load of an on-line course is exasperated by the low retention rates associated with it. One problem surprised the investigator. The respondent indicated that communication with students was a problem. When she sent E-mails to her students, she had no guarantee they would read them. Students also failed to report their progress on a regular basis. Other problems included testing centers losing tests, on-line sections being too large, and a lack of support.

When asked about problems experienced by the students, respondents indicated the lack of self-discipline as the primary problem. Students seem to put off doing assignments. This would tie in with the response mentioned earlier about students not reading their E-mail or reporting on their progress. An instructor may send out the weekly assignment or materials at the beginning of the week and expect assignments to be returned by the beginning of the next week. Students may wait until the end of the week to go to the web and then try to do in one or two days what they should have been thinking about all week. This, again, points up the need for self-evaluation instruments for potential on-line students. Other difficulties noted included problems getting course materials and an unfamiliarity with the Web. Two respondents indicated that WebCT makes tasks easier for the students.

Most respondents indicated a need for technical support both for themselves and for their students. One respondent stated that "technological savvy" is needed to make the task easier and "to answer the questions posed by some students." Several respondents implied, if not stated, that they have become the technical support for their students. One respondent stated that "you need technological and financial support to be successful." Only one respondent indicated that his college provided technical training for faculty in a Faculty Development Center. Another stated that her college had hired a technician to help instructors put the materials on-line. One respondent indicated a problem with viewing slides developed on Power Point Equation Editor on the browser, NetScape Navigator. He indicated that he solved this by importing Microsoft Internet Explorer. Perhaps more important to mathematics faculty, some respondents stated that they have problems putting math symbols on their web sites. An even broader problem is trying to use math symbols in E-mail and in chatrooms. A couple on-line math instructors interviewed, but not included in the survey, indicated that some students can be quite creative in trying to overcome this obstacle. Lack of communication between the "Webmaster" and the community can also cause problems. One respondent related that his college's "'Webmaster' decided to restructure the college's web site and moved all my course folders - without telling me or my students!"

The respondents were asked what percent of their students have access to the Web. They all indicated 100%. This answer, however, was based on the availability of labs and PC's on campus not necessarily on the students owning the necessary equipment or having access to it in their homes. All respondents indicated that all students had access to the Web via labs and other sites with Internet access on campus. One respondent said that only about half of the students had Internet access in their homes. Another noted that students without access to the Web at home or at work were unlikely to sign up for an on-line course.

Several formats for testing were reported . Two respondents reported that in some sections testing is done on-line. Another indicated that quizzes are given on-line, but students must come on campus to take tests. Most respondents referred to on-campus test centers and / or off-campus sites. Usually a picture ID is required. No one indicated how they insure that the actual student, and not a substitute, takes the on-line tests and quizzes.

Summary, Conclusions, and Questions

Out of the 774 web sites for two-year colleges across the country visited by the researcher, 34% indicated that the college offered on-line courses, but only 10% indicated that they offered on-line mathematics courses. The question remains as to why. Is it because the mathematics faculty do not feel this is an appropriate format for mathematics education? Is it due to the the difficulty in communicating mathematics in E-mail and chatrooms? Is it because the time required is so much greater than traditional formats and the resulting retention rate is lower? Perhaps it is simply that the technology is new. As was seen, New Jersey will go from 5% of its nineteen community colleges offering on-line math courses in the 1999 Spring Semester to 26% in the 1999 Fall Semester.

If colleges plan to offer on-line courses, they must be ready to provide technical support for both the faculty and the students. For the students, this should include a twenty-four hour help line. The technicians manning this line must not only be able to help correct problems with the server, but also answer questions posed by the students on how to get their PC's to do what needs to be done or how to use needed software. The twenty-four hour a day, seven days a week availability is essential. Students in the two-year colleges, even more than those in the four-year institutions and universities, follow very diverse work, college, and study hours. If they have problems at 3 AM, and cannot get to the help line until 9 PM the next day due to their classes and / or job responsibilities, the process will not work. Workshops on self-motivation and self-disciple should be made available to the students as well as training on the use of the Web including E-mail and chatrooms. This latter training should not be left to the individual course instructor.

Technical support for the faculty must be in several forms. First, faculty need training on web site development, strategies for using the Web effectively, and how to use the necessary software, E-mail, and chatrooms. As one on-line specialist stated in an interview, "This is a brand new way of teaching." You are not just electronically mailing your lecture. Second, they may need technological assistance to set up and maintain their course web sites. Third, they will also need a help line to answer problems, to get the Web up and running again when it goes down, and to help answers questions posed to them by their students. Finally a "Webmaster" must be employed who understands the unique needs of a college community which is offering on-line courses. This should be a full-time position, not something tacked on to some employee's already busy schedule.

On-line courses are not for everyone. That is true for both faculty and students. Educators need to determine the characteristics that will allow a student to be successful in an on-line course. Colleges need to either develop or purchase and then implement some type of self-evaluation tool to help guide the students. Otherwise the retention rates will drop lower than they are now. Faculty members must also be assisted in determining if this teaching format matches their style and personality. The occasional faculty member who sees teaching on-line courses as a way to an "easy schedule" needs to be educated to the true demands of this type of course and possibly urged not to teach this format. To be fair, colleges must be ready to provide on-line teachers with release time to develop and maintain the on-line courses and their web sites. They must also be willing to set enrollment limits to twenty students for on-line courses.

Adequate hardware is also a major consideration in going on-line. Faculty members must have easy access to the Web both on campus and at home. One of the greatest claims for on-line courses is the availability of help from faculty members via E-mail. This means that a faculty member is expected to check the E-mail seven days a week. This will not happen if the instructor only has access in his or her office on campus. This raises two questions. Should faculty members be assisted in purchasing equipment or be provided equipment to use at home? Second, should faculty members be at least partially reimbursed for Internet access charges? Students also need access to the Internet. This means colleges must provide adequate access sites for students on campus. However, there is another set of questions already raised by some education writers. Does this set up inequity for certain groups of students who cannot afford Internet access in their homes. Do colleges have the responsibility of providing the necessary hardware for students who cannot otherwise afford it? Using the access on campus is not really an adequate answer. If a student must go to a lab on campus, a major part of the flexibility touted by this format has been lost. A student who only has access to the course web site, E-mail, and chatrooms once or twice a week will be at a definite disadvantage compared with a student who has daily access at home or work.

Colleges must not look at on-line courses as a way to "offer more for less." If they are to provide adequate on-going technological and financial support for the system, maintain the hardware, and keep the class sections at a suitable size, on-line education may turn out to be very expensive. The investigator found that some colleges have already formed consortia to offer on-line courses. Perhaps this in part is due to cost. However, this raises questions, at least for the investigator. Will this lead to larger and perhaps educationally ineffective sections? Will local departments lose control of their courses? If a course is offered by a consortium of five colleges, which department decides the content of the course? It is frequently difficult for a single department to make this decision let alone five departments combined. The fact that the course may be taught by a person who is not a member of any of the departments also raises concern.

This is an exciting and challenging time for mathematics education at the community college level. As indicated, although the percent of colleges offering on-line math courses is small, there will be rapid growth in the next few semesters. If the surveys show an accurate picture, New Jersey's community college system is on par with its counterparts across the country in on-line math education. There are many opportunities open now that were never there before. But there are also major questions to be answered and potential disasters to be avoided. Mathematics education groups such as AMATYC, MAA, and NCTM must take the lead in researching some of the questions and in providing training for their members in the effective uses of the new technology in community college mathematics classes.

Appendix A
Using the Net to Teach Mathematics
Questionnaire Form A

1. Do members of your Mathematics Department currently use the Internet to support any of their courses?

____ Yes (**If yes, please complete Section A.**)
____ No (**If no, please skip Sections A and B and complete Section C.**)

Section A (Please complete this section only if your answer to question 1 was "yes".)

2. The net is used to support math courses by
____ most of the members of our department
____ about half of the members of our department
____ only a few members of our department
Comments:

3. If at least one section of a course listed below uses the Internet in some way, please put a check to the left of the course. Also place a check in the column(s) that indicates how the net is used.

		S M	C R	AP	E M	Full	Other (please specify)
___	Basic Skills	___	___	___	___	___	
___	Statistics	___	___	___	___	___	
___	Precalculus	___	___	___	___	___	
___	Calculus	___	___	___	___	___	
___	Linear Algebra	___	___	___	___	___	
___	Differential Eq.	___	___	___	___	___	
___	Other		___	___	___	___	___
	(Please specify)						

S M - support material such as syllabi. class notes. assignments etc. are given on the net
C R - chatroom is provided for the students to discuss their work with each other
AP - the net is used as a resource for applications and / or research topics
E M - E-mail is utilized as a communication link between faculty and students
Full - the complete course is offered in "distance learning" mode on the net.

4. Please comment on any positive outcomes from utilizing the Internet in your math course(s).

5. Please comment on any negative outcomes from utilizing the Internet in your math course(s).

Please complete Section B only if you offered at least one section of math over the Internet as a distance learning option. If you did not. please skip to section D.)

Section B: (only for courses offered on the Internet as a distance learning option)

6. Is the syllabus for the Internet section(s) basically the same as the syllabus for the non-Internet sections?
___ Yes ___ No (If no. please comment on differences)

7. Is the level of presentation for the Internet section(s) basically the same as the level for the non-Internet sections? ___ Yes ___ No (If no. please comment on difference)

8. Is the retention rate for the Internet section(s) basically the same as the retention rate for the non-Internet sections? ___ Yes ___ No (If no. please comment on difference)

9. How do you conduct testing for the Internet section(s) ?

10. What type of technical support does your college provide for your Internet section(s) ?

11. What upper limit do you believe should be placed on the size of an Internet section?

12. Does your college have an upper limit for the enrollment in an Internet section?
If yes, what is it?

13. Do you use a screening device to determine if a student is a suitable candidate to successfully take a distance learning course over the Internet?

14. Have you encountered any major problems in offering courses over the net?
(If yes, please comment on the problems and give any suggestions that might help others avoid having the same problems.)

Please Skip to Section D

Section C (Please complete this section only if your answer to question 1 was "no".)

15. What do you see as the primary reason(s) your department does not use the net?
(check as many as appropriate)
____ Lack of adequate support for the idea within the department
____ Lack of adequate support from the administration
____ Lack of adequate hardware
____ Lack of adequate funding
____ Lack of adequate training for faculty
____ Other (please specify)

Comments

16. Does your department expect to use the net in any of its courses during the academic year 1999-2000?
_____ Yes ____ No ____ Uncertain

(Please complete Section D.)

Section D

Please give Your Name ____________________________

Your College ____________________________
May I contact you if I have further questions? ___ Yes ___ No

If yes, would you prefer me to ___ call - phone # ______________________

___ use E-mail - address ___________________

Would you like me to send you a copy of my final report? ___ Yes ___ No

Thank you very much for your help

Please return this questionnaire by Friday, April 16, 1999.
to Dr. Charles Miller
Mathematics Department
Camden County College
P. O. Box 200
Blackwood, NJ 08012.
Or cjmiller@email.njin.net

Appendix B

Using the Net to Teach Mathematics

Questionnaire Form E

Section A (General)

1. The net is used to support math courses by

    ____ most of the members of our department
    ____ about half of the members of our department
    ____ only a few members of our department

    Comments:

2. If at least one section of a course listed below uses the Internet in some way, please put a check to the left of the course. Also place a check in the column(s) that indicates how the net is used.

		S M	C R	AP	E M	Full	Other (please specify)
___	Basic Skills	___	___	___	___	___	
___	Statistics	___	___	___	___	___	
___	Precalculus	___	___	___	___	___	
___	Calculus	___	___	___	___	___	
___	Linear Algebra	___	___	___	___	___	
___	Differential Eq.	___	___	___	___	___	
___	Other (Please specify)	___	___	___	___	___	

S M - support material such as syllabi. class notes. assignments etc. are given on the net
C R - chatroom is provided for the students to discuss their work with each other
AP - the net is used as a resource for applications and / or research topics
E M - E-mail is utilized as a communication link between faculty and students
Full - the complete course is offered in "distance learning" mode on the net.

Section B: (only for courses offered on the Internet as a distance learning option)

3. Is the syllabus for the Internet section(s) basically the same as the syllabus for the non-Internet sections? ___ Yes ___ No (If no, please comment on differences)

4. Is the level of presentation for the Internet section(s) basically the same as the level for the non-Internet sections? ___ Yes ___ No (If no, please comment on difference)

5. Is the retention rate for the Internet section(s) basically the same as the retention rate for the non-Internet sections? ___ Yes ___ No (If no, please comment on difference)

6. How do you conduct testing for the Internet section(s) ?

7. What type of technical support does your college provide for your Internet section(s) ?

8. What upper limit do you believe should be placed on the size of an Internet section?

9. Does your college have an upper limit for the enrollment in an Internet section?
   If yes, what is it?

10. Do you use a screening device to determine if a student is a suitable candidate to successfully take a distance learning course over the Internet?

11. Have you encountered any major problems in offering courses over the net? (If yes, please comment on the problems and give any suggestions that might help others avoid having the same problems.)
    a) Problems experienced by faculty

    b) Problems experienced by students

    c) Problems with the technology

12. What percent of the students at your college have access to the Web?

13. How do you accommodate students who do not have a PC with modem in their homes?

Section C

Please give your name ______________________________

Your College ___________________________

14. May I contact you if I have further questions? ___ Yes ___ No
    If yes, would you prefer me to ___ call - phone #________________
    ___ use E-mail - address ________________

15. Would you like me to send you a copy of my final report? ___ Yes ___ No

Thank you for your help.

Please return this questionnaire by Friday, April 30, 1999.

to: cjmiller@email.njin.net or

Dr. Charles Miller
Mathematics Department
Camden County College
P. O. Box 200
Blackwood, NJ 08012.

Appendix C

Participating Colleges

Representatives from the following New Jersey community colleges responded to Questionnaire A:

Atlantic Cape Community College
Bergen Community College
Brookdale Community College
Burlington County College
Camden County College
Cumberland County College
Gloucester County College
Hudson County Community College
Mercer County Community College
County College of Morris
Ocean County College
Passaic County Community College
Raritan Valley Community College
Salem Community College
Sussex County Community College
Union County College

Representatives from the following two-year colleges responded to the national Questionnaire E:

Community College of Southern Nevada, Nevada
Oakton Community College, Illinois
Springfield Technical Community College, Massachusetts
Tomball College, Texas
Volunteer State Community College, Tennessee

Cooperative Learning in the Community College Biology Classroom

By Doris C. Morgan, AssociateProfessor
MIDDLESEX COUNTY COLLEGE,
EDISON, N.J.

PRINCETON UNIVERSITY MID-CAREER FELLOWSHIP PROGRAM

May, 1999

SCIENCE TEACHING:TRADITIONAL METHODS

Traditional methods of teaching science have come under increasing attack for decades. Critics have asserted that the traditional "stand and deliver" style of teaching no longer does the job, that it fails to develop students' critical thinking and problem-solving skills, and that it suppresses natural creativity and curiosity. Many college students today view the study of science as a tedious process involving rote-memorization of volumes of terms and facts with few interrelationships and little, if any, relevance to their daily lives.

Traditional science teaching methods have also increased "science anxiety" in many students and have contributed to what Karen Knorr-Cetina calls "the crisis of legitimacy in science". Knorr-Cetina states that "science is no longer taken for granted as a social resource, even by the general public". (Knorr-Cetina, 1981).

Science is not only a collection of facts but is a series of interdependent conversations between scientists and nature, and between scientists and other scientists. There is a relationship between the knowledge that science accumulates and the intellectual tradition that contributes to this accumulation. Acquainting the students with science is actually done in order to help them become members of the pragmatic intellectual community that science teachers represent, and should be among the first priorities of college and university science education. (Bruffee, 1993).

The failure of college science education to do this has resulted in a significant decrease in the number of students entering the field of science and math today. (Tobias, 1978) In the past twenty-five years "the proportion of college freshmen planning to major in science fell by half". (Tobias, 1990)

COOPERATIVE LEARNING IN BIOLOGY

Cooperative learning is the instructional use of small groups so that students work together to maximize their own and each others' learning. (Johnson, Johnson, and Smith, 1991b) In biology, students usually work in small groups in the laboratory, but in the lecture the instructor more often uses the traditional lecture or lecture-and-discussion format. Both methods are effective for the motivated, actively participating student, but the shy, less confident, more easily intimidated student is often left out of the discussions, further increasing isolation.

Faculty who are hesitant to "take time out" for group work and student-to-student interaction during lectures cite pressures to "cover the material", especially in classes of Health Technology students (Nursing, Dental Hygiene, Medical and Radiation Technology) that are being prepared for rigorous, intensive, and comprehensive Board Exams. Reserving class time for student involvement in small-group learning is often seen as requiring course content to be compromised.

Yet cooperative learning researchers and practitioners have shown that positive peer relationships are essential to success in college. (Smith, 1996) Studies have shown that two major predictors of lack of success in college are failure to establish a social network of friends and failure to become academically involved in classes. (Tinto, 1994) Working with small groups of medical students, Abercrombie found that students were better able to make medical judgments, to arrive at an unbiased consensus, and to diagnose patients faster and more effectively because they tended to "talk each other out of unshared biases and presuppositions". (Abercrombie, 1969)

BIOLOGY AS A LANGUAGE AND A SOCIAL EXPERIENCE

Students in introductory biology find that learning it is, in effect, like learning a new language. Yet we provide no "biology language lab" where students could practice using clinical and technical terminology, writing scientific terms in sentences, reading terms aloud, listening to the words used in context, and searching for meanings and interrelationships.

Learning is known to be a social experience; this is no less true in biology. Small-group, cooperative learning activities encourage students to work together, to help each other, to "bounce ideas off of each other", and to learn to "talk the talk" of science. Small group discussions allow students to "feel like they are becoming members in the discursive community". (Isenberg, 1991) It also converts "passive" learners into "active" learners who begin to "own" the course material and to gain control of their learning process. This does not mean that students won't learn important course content. Instead, "cooperative small-group activities involve shifting the professor's focus from covering course content through class presentations to devising activities that explicitly help students to "discover" and master essential course material. (Crawley, 1999) As Mortimer Adler once noted, "All genuine learning is active, not passive. It involves the use of the mind, not just the memory. It is the process of discovery in which the student is the main agent, not the teacher".

SMALL GROUPWORK IN BIOLOGY LECTURES

Two methods used in my biology lecture classes are the Introductory (Icebreaker) Workshop and the Small-Group Discussion. Students find that working in groups of three to five students is less intimidating than raising their hands to ask questions or to participate in class discussions. In small groups, students can all participate and the teacher is then free to circulate among the groups as a "guide at the side" rather than a "sage on the stage". Student-to-student interaction helps each student develop critical thinking and problem-solving skills while they begin the formation of small social groups. Students report that they feel more comfortable and relaxed in the class and are less overwhelmed by the course content; they also feel less intimidated by the professor. In small groups students are more likely to "take risks", to ask "stupid questions", and to say, " I don't know" or "I'm not sure". They lower their defenses and are thus more open to real communication and learning. They also begin to see things from "different angles" and start to appreciate others' points of view and ways of learning.

THE INTRODUCTORY (ICEBREAKER) WORKSHOP

During the first lecture class of each semester, after students have been given the course syllabus and have had the course requirements explained, a handout sheet is distributed. Directions are as follows:

INTRODUCTORY SMALL-GROUP WORKSHOP

DIRECTIONS:

A. Work together in groups of four, arranging your desks to form a small circle.

B. Each student in your group is to choose one question from those listed below and will then interview each group member, using the question chosen. As you question each member, record their answers in your notebook or on a piece of paper. Include your answer to the question as well.

C. Repeat this process for each of the four questions. (Student #2 asks each group member question #2, student #3 asks each member question #3, etc.).

D. You have 30 minutes to conduct and record all of the interviews; assign one member of your group to be the "timekeeper". Assign another group member to keep the group focused on the task.

E. After the workshop is completed, each group member will read his/her answers to the class.

Questions:

1. What is your name? Your curriculum? Your year at college? What are your career goals?

2. Why are you taking this course? What do you hope to learn in this class? Which course topics are of particular interest to you?

3. Where do you live? What are your interests/hobbies?

4. List some of the benefits and some of the problems (economic, social, and ethical) that have resulted from modern biomedical research and technology.

When the 30 minutes are up, students are asked to return their desks to their original position in the room. Students in each group who chose question 1 now report their group's answers to that question; students 2, 3, and 4 follow suit. The reporting process takes about 50 minutes, therefore, the entire workshop takes approximately 80 minutes.

Some faculty have told me that they would not want to use their entire first lecture session for what they evidently consider a "waste of time". However, it has been my experience that using the first lecture period in this way is time well spent because:

1. It allows students to get to know each other on a personal level. It reduces feelings of isolation and facilitates the formation of study groups outside of the classroom and the sharing of ideas and problems inside the class.

2. Students emerge from this first workshop feeling less overwhelmed by the course syllabus, less intimidated by the professor, less "alone", and more relaxed. (They **love** it!)

3. The atmosphere created during this first session sets the tone for the rest of the semester. Student participation in lecture discussions increases, students are less hesitant to ask questions, and they feel more in control of their own learning process.

4. It helps students to clarify their own course goals and interests and it gets them to focus on the topics in the course from the very start.

5. Students begin to "get a feel for" learning by thinking critically. They also start to listen to each other more closely

and begin to toss around ideas without worrying that they will say the wrong thing or give the wrong answer.

6. Students start to appreciate the viewpoints and thinking of others. This is important in classroom settings with the increasing ethnic, social, educational, economic, gender, and age diversity that we see today at community colleges.

SMALL GROUP WORKSHOP: THE SPINAL CORD

Students are given a reading assignment prior to the day scheduled for this workshop.

DIRECTIONS:

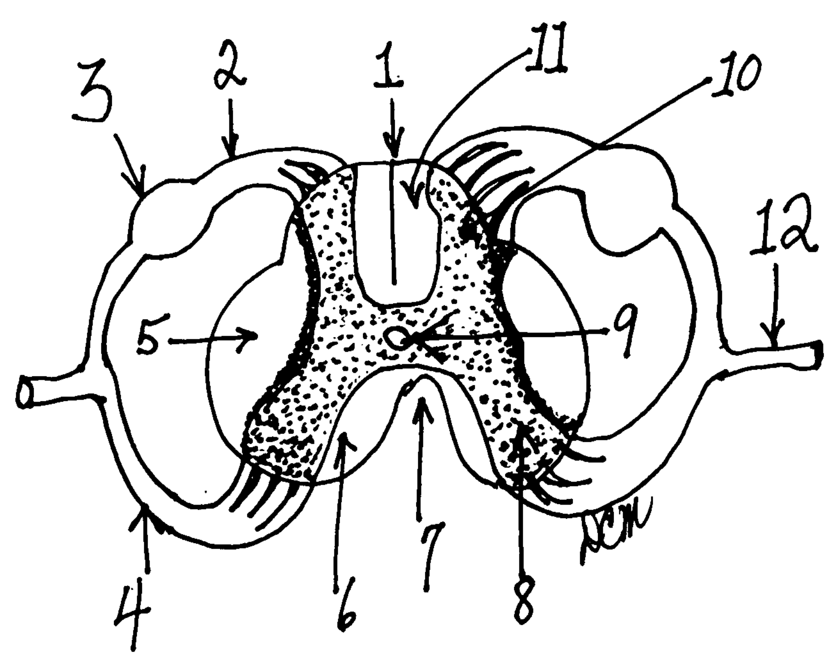
A. Work in groups of three to five students, arranging your desks in a small circle.

B. Using your textbook readings assigned for today, work together as a group to answer the following questions.

C. You have 30 minutes to complete this workshop. Assign one member of your group to be the "timekeeper". Assign another member to record the answers for the group (the "recorder").

Questions:

1. Label the sketch of a cross-section of the spinal cord below using the list of answers located beneath the diagram. Place your answers on the lines below the list of terms.



List of Terms:

Central canal
Anterior funiculus
Dorsal root
Posterior gray horn
Dorsal median sulcus
Posterior funiculus
Ventral median fissure
Dorsal root ganglion
Ventral root
Lateral funiculus
Anterior gray horn
Spinal nerve

Your Answers:

1. ____________________
2. ____________________
3. ____________________
4. ____________________
5. ____________________
6. ____________________
7. ____________________
8. ____________________
9. ____________________
10. ____________________
11. ____________________
12. ____________________

2. Draw a horizontal line through the spinal cord diagram, right through the central canal. Label the gray matter above and below the line with a letter "S" if the region is sensory, and with an"M" if motor.

3.a. What structures are located in regions 6, 7, and 12? ____________________

____

3.b. What structures are located in regions 9 and 11? ____________________

____

4. On the back of this paper sketch a "flow chart" listing, in order, the parts of a spinal "reflex arc". Define the term "reflex" and give several examples of reflexes in the body.

At the end of the thirty minutes, the students move their desks back to their original position in the room. The instructor draws the diagram of the spinal cord on the chalkboard, and asks students to use their answers to label it. A class discussion of the answers to questions 2, 3, and 4 follows.

As a result of this workshop the following results were evident:

1. The students seemed to learn the anatomy of the spinal cord much faster and were less confused by the pictures of it labeled in their textbook.

2. Students were better able to relate each structure to its function.

3. Class participation "went through the roof"! Students who previously may have been hesitant to answer in class or who were afraid to ask questions now were able to participate in a more confident manner.

4. Learning the structure of the spinal cord cross-section and the function of the spinal cord structures seemed to occur more easily.

5. Listing the parts of a reflex arc and examples of typical reflexes made the class discussion more interesting and relevant to the experiences of the students.

COMPUTER-ASSISTED COOPERATIVE LEARNING

Some of the lab sections in Human Anatomy & Physiology at Middlesex County College are presently using computer programs (A.D.A.M. and Interactive Physiology CD-ROMS from A.D.A.M Software and Benjamin/Cummings) to simulate human cadaver dissections and human physiology experiments. Computer-assisted laboratory exercises are ideal for cooperative, small-group learning. Students may work in pairs on one computer or, better yet, if the computers are clustered in groups of four, small groups of students may work together while completing their answers in a tutorial booklet.

At Vanderbilt University, human cadaver dissection in the Nursing Department's anatomy laboratory have been completely replaced with interactive, computer-based programs. A study is currently being conducted by Alvin M. Burt, Ph.D. to determine the effectiveness of the computer-based laboratory. At Middlesex County College, a similar study will be conducted. How effective this type of laboratory will prove to be remains to be determined.

FIELD TRIPS AND COOPERATIVE LEARNING

Mario W. Caprio uses small-group cooperative learning for group projects such as field trip reports. He believes that cooperative learning combined with activities of this sort "encourage lifelong learning of science by revealing it as both emotionally and intellectually satisfying". (Caprio, 1993)

SUMMARY

There are many ways that college professors can use small-group cooperative learning exercises in lecture, laboratory, and in discussion classes. My opinion is that this is particularly important in the community college because of the diversity of the students, because students are commuters and do not have the time to get together on a regular basis out of class, and because it maximizes learning in a time-proven and well-researched manner. It gives students an increased chance of achieving course goals. In an expository classroom, many of these students would only have their lecture notes and their textbooks to rely on. Small-group learning gives them alternate sources of information, teaches teamwork, is enjoyable, and lets the learning occur through social interaction and group dynamics. Preparing for cooperative learning sessions is hard work for the professor and it takes much practice, but it is certainly worth the time and the effort. The rewards are not only academic.

A leader is best

When people barely know he exists,

Not so good when people obey and acclaim him,

Worst when they despise him.

But of a good leader, who talks little,

When his work is done, his aim fulfilled,

They will all say, "We did this ourselves."

Chinese philosopher Lao-Tse (Bynner, 1962)

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NON-TRADITIONAL INSTRUCTION

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INTRODUCTION:

The focus of this paper is to present non-traditional or alternate instructional methods in remedial mathematics education at the two year level, however, these methods will apply to credit math courses as well as courses from other disciplines. With the large number of students needing remediation and the United States traditionally scoring low on international tests, we at the community college level face the challenge of rethinking our curriculum and our methods of instruction.

THE PROBLEM:

According to a study in 1995 by the U.S. Department of Education, 78% of higher education institutions offered remedial writing courses and 72% offered remedial mathematics courses. The percent of all entering first time freshmen, in all United States colleges, that enrolled in either a reading, writing or math course was 29. However, at two-year public institutions 41% enrolled in remedial courses and overall more first time freshmen enrolled in remedial mathematics (34%), then writing (25%) and reading (20%). At Middlesex County College, we run approximately 80 sections per semester of basic mathematics and algebra, which is comparable to community colleges across the United States. The Third International Mathematics and Science Study conducted in 1994-1995 shows the average score of a thirteen year old in mathematics was 500 with Singapore finishing first (643), South Korea second (607), Japan third (605), France thirteenth (538) and the United States twenty-eighth (500). As part of the TIMSS assessment, classroom instruction was video taped and differences were discovered. According to "The TIMSS Videotape Study," American

Educator, American Federation of Teachers, one of the main differences between math education in Japan and the Unites States is the approach to instruction. U.S. instructors teach a skills-based curriculum in which students learn by example and repetition. Japanese instructors use a problem-based curriculum; they believe students should struggle with a problem first, make mistakes, and reflect on their errors before it is possible for them to understand the topic. An article in the *New York Times* by Edward Robinson, "Technology", contained this problem on the TIMSS twelfth grade advanced mathematics test: "A string is wound symmetrically around a circular rod. The string goes exactly four times around the rod. The circumference of the rod is 4 cm. and its length is 12 cm. Find the length of the string. Show all your work." Although this question requires only basic math and geometry principles, this was one of the hardest questions on the test. Only 12% of all students got at least part of the problem correct with 10% solving it. However, the average for the United States students was 4% for a complete solution, with no significant partial solutions.

THE STUDENTS:

The students who attend community colleges in the United States come with diverse academic and ethnic backgrounds and maturity levels. We have the adult student who is self-motivated, but finds he or she may need remediation due to a lapse of time in his or her formal education. We also have the students who need no remediation but see the community college as an inexpensive alternative to higher education. The majority of students, however, are there because either their academic record is poor not allowing entrance into a four year school, or they really don't know if they want to attend college and are giving it a try (usually under parental pressure), or their maturity level does not lend itself to a four year college. Most likely it is a combination of all of the above. Many students have poor study habits because in high school they only studied enough to "get by." In mathematics especially, students enter with a math anxiety; after many years of poor performance they are convinced they can not comprehend the material. They enter the community college not only thinking they are inferior to students entering four year institutions due to their past performances, but also due to the misconception of the community college, fostered by high school personnel and four year college administrators, that two-year colleges are an inferior product. Many students are at a lower level academically not necessarily because of intelligence, but because of a lack of motivation, self-esteem and maturity.

LEARNING STYLES:

We all have our individual style of learning. Some of us learn in many ways but we retain more if what is learned is acquired in the style to which we are attuned. Learning style is the way people concentrate on, internalize and remember new and difficult knowledge or skills (R. Dunn and K. Dunn, T*eaching Students Through Their Individual Learning Styles:A Practical Approach*, Englewood Cliffs, N.J.:Prentice-Hall, 1978). It is composed of cognitive, motivational, and physiological elements that affect each person's ability to perceive, interact with, and respond to the learning environment (J.W. Keefe, "Assessment of Learning Style

Variables: The NASSP Task Force Model," *Theory into Practice* 24(1985):138-43. The four main learning styles are visual, aural, reading/writing, and kinesthetic. For example, in a questionnaire to assess ones learning style, a sample question is: "You are about to give directions to your house to a friend staying at a hotel, would you: a. draw a map; (*visual)* b. write directions; *(reading/writing)* c. tell the directions; *(aural)* or d. offer to drive to the hotel and take your friend to your house *(kinesthetic).*" At the end of the questionnaire students are given instructions on tallying the results and offered suggestions on how to alter their study skills in order to maximize their capacity for learning and retaining material. (Fleming, N.D., & Mills,C. (1992). Not another inventory, rather a catalyst for reflections.*To Improve the Academy, 11,* 137-155) It is beneficial for every student to understand which is his or her natural learning style.

INSTRUCTIONAL METHODS:

What role does the community college instructor play in educating under prepared students with varied learning styles? I believe that we can make some difference in the classroom by altering our teaching methods to accommodate different learning styles. We must be willing to experiment with new venues of instructional methodology and approach such methodology with an open mind. The following is an instructional technique that I have found useful in my classes:

Ice Breakers: I believe Ice Breakers are essential in a community college classroom because they create a relaxed atmosphere and diminish, to a degree, the feeling of isolation inherent in commuting students. There are many books devoted to the topic of ice breakers; I offer the following, which I learned at a workshop and I use in all my classes. I group students in twos, threes, or fours and I ask them to get to know each other, I also tell them this might be a good time to exchange telephone numbers and many do. After they talk for about ten minutes, I ask someone in the group to introduce another person in the group to the class and tell something about that person. Everyone in the class has a chance to speak. This is a useful exercise because students find other students with similar interests, but it is also very revealing because often what is voiced in the remedial class is the fear of mathematics and the fear of failing. This expression of fear allows me to establish, on day one, a positive attitude towards a new beginning in the learning of mathematics and my belief that they can learn the material through hard work. Besides creating a non-threatening atmosphere, the ice-breaking technique lends itself nicely to cooperative learning activities which I also use on the first day.

COOPERATIVE LEARNING

Because much has been written about cooperative learning over the past ten years, many instructors believe this is not an alternate instructional method, but rather a traditional method. However, I met many instructors at national mathematics conferences who have not tried cooperative learning in their classes and some that are unwilling to try it at all. Workshops on this topic are always in demand. Instructors want to know what is this panacea for mathematics education and how will it transform students into eager learners. Cooperative learning should not be looked on as a cure-all to mathematics education but rather as a technique, along with other techniques, that can be used to motivate, and in many instances, stimulate critical thinking. Although cooperative learning is touted as a new approach to education, two instances in which team learning was implemented in my elementary education are prominent in my mind. One was in geography when the class worked together on a project on Alaska and another was a writing assignment in which we had to read and help edit each other's papers. The fact that these are my main memories of my elementary years illustrates what a powerful tool cooperative learning can be. In addition to a valuable educational technique, it is also what industry wants. When asked what employability skills were important to succeed in industry, employers responded with answers such as: listening and oral communication, competence in reading writing, and computation, creative thinking and problem solving, and group effectiveness.(Workplace basics: The skills employers want.(1988). American Society for Training and Development and the U.S. Department of Labor. According to Karl A. Smith, a noted lecturer on cooperative learning from the University of Minnesota, "Cooperative learning involves people working in teams to accomplish a common goal, under conditions that involve both positive interdependence and individual and group accountability." Cooperative learning activities must be carefully structured to insure total involvement. Guidelines and evaluation must be explicit. What activities are appropriate for cooperative learning? We just have to look to Japan for one possibility. Japan uses a problem solving approach to introduce lessons. For example, when addition of fractions is taught in Japan the students are not told the correct method to use but instead are given problems to struggle with. The teacher then compiles the methods, and together with the instructor the students rule out inappropriate methods, and determine the correct method of solution (TIMSS Videotape Study). Any class, large or small, remedial or advanced lends itself in some way to cooperative learning.

A TOTALLY COOPERATIVE CLASSROOM:

At Middlesex County College we are presently offering sections of Freshman Mathematics that are being taught collaboratively. The object of the course is to learn mathematics through problem solving. The course is composed of a series of problems, and students must solve these problems cooperatively using strategies that are introduced throughout the semester. The problems are divided into two sets. Set A is done in class cooperatively and set B is done outside of class, either individually or cooperatively, and submitted for a grade. I sat in on one class this semester and the following are my observations:

When I arrived at Professor Boyd-DeMarzio's Freshman Math Class the students were in groups discussing a previously worked problem. When one group was called upon to present their problem they comfortably went to the front of the room to start the discussion. The instructor took a seat with the students. One student read the problem:

> Harum and her friends went to play on an island about 1/4 mile offshore at the lake. The small sailboat available to them can only take 220 pounds at a time. Harum weighs 120 pounds, Sam weighs 100 pounds, Eliza weighs 95 pounds, Carman weighs 110 pounds, and Les weighs 140 pounds. How many trips does it take to get them off the island? (Problem Solving Strategies:Crossing

the River With Dogs and Other Mathematical Adventures, Ted Herr & Ken Johnson, Key Curriculum Press 1994.

One student went to the board and started the explanation listing the restrictions on the boat as they pertained to the people in the problem. The other students in the group acted out the problem as the narrator continued the explanation. As the group presented their findings, the rest of the class was involved either as counters for the number of trips or as listeners to make sure the boat did not capsize. The group completed the problem successfully using seven trips. Afterward the presentation was open to questions and comments and other students offered different ways of solving the problem. The problem was then reevaluated to determine the minimum number of trips to achieve the desired results. During this session the instructor acted as facilitator. Rather than explaining the answers, her comments were: "I don't understand... you must show me... you must explain in detail." When I interviewed Professor Boyd-DeMarzio after class, she stated the purpose of the course is to develop specific problem solving strategies and communication skills, and also to foster an enjoyment of math. Do the students in this situation enjoy math? According to a survey written by Dr. Luke, Dean of Heath Technologies, Science, and Mathematics at Middlesex County College, and administered to all students taking Freshman Mathematics, 78% reported a changed attitude toward mathematics, with comments such as: "less fearful of math,...math seemed more practical,...first time I really enjoyed a math class." An interesting comment on the survey was students felt that the group depended on them therefore attendance was important. In fact, 95% said that attendance was important and 94% said they would recommend the class to other students, although some cautioned only if they felt the student had the ability, while others stated only if the student liked to work in groups.

THE SMALLER CLASS:

Although the above model seems to work well, many subjects, especially in mathematics, do not lend themselves to total cooperative learning. The struggle exists between "covering the material" and the amount of time needed to successfully challenge students to discover the information. To allow for different learning styles in the small classroom, I suggest using teaming projects throughout the semester in conjunction with lecturing. The following is a math problem I have used prior to any discussion of maximum value:

> The ABC Company, which you work for, manufactures widgets. Your department has been commissioned to determine the dimensions of the rectangular open box that should be used to maximize the number of widgets that can fit into each box. If the piece of cardboard available measures 8 1/2 by 11 in. find the measurement of the largest open box that can be formed.

When students first see this problem they do not know how to begin. They do not realize that they have the material in front of them and that they can physically cut the material. They always ask what the formula is, or how do we start this. I tell them to read the directions and discuss options with members in their group. As the groups realize that they need scissors and rulers, I supply them. As I sit with each group we determine reasonable cuts to make and assignments to give each group member. After all groups finish, they report on the findings and arrive at the answer. I then introduce the appropriate mathematical techniques, depending on the class, and we see that the answer we arrived at experimentally is very close to the actual answer. One of the difficult parts of using cooperative learning for an instructor is not to tell the students how to proceed but to wait and give support by asking leading questions.

THE LARGE CLASS

Lecture has become an unwelcome word in modern pedagogy but we cannot totally abandon lecture in the classroom. Knowledge must be disseminated in some fashion, whether through reading, seeing, doing, or hearing. If we are to truly allow for individual differences, the lecture must remain a part of education since many people are auditory learners. Total lecture, however, is no longer as effective as it once was. There are various theories for this, ranging from our technological society with its instant gratification to a lessening of self-discipline in general. Whatever the reason, effective classes must utilize different teaching strategies. What then can be done with the large lecture class? At I workshop I attended, Karl Smith, illustrated a film of a physics lecture class containing about 200 students. In the middle of the lecture the professor stopped and asked students a yes/no question on the material he had just taught. The students were instructed to register their vote with a show of hands. The answers were mixed. The professor then asked each student to confer with someone sitting next to him or her and come to an agreement on the answer. He then called for another show of hands and the correct answer was given by the majority of students. This activity took a small amount of time but it gave students a chance to comprehend, digest, and process the information just presented.

TECHNOLOGY:

As we enter the twenty-first century, technology is advancing in leaps and bounds. We as educators are in the process of defining what role technology will play in the classroom. Graphing calculators have been commonplace for the past six years, yet many schools have not incorporated them into their curriculum. Graphing calculators are a good tool for visual learners. Calculators and group work can go hand in hand. Consider the following learn by discovery problem using the graphing calculator:

1. Graph $y = x^2$, $y = \frac{1}{3}x^2$, $y = \frac{1}{2}x^2$, $y = \frac{3}{4}x^2$, $y = 5x^2$, $y = 10x^2$ and $y = 24x^2$ on the same coordinate system.

2. Decide how the coefficient of x^2 affects the graph.

3 Describe how the graph of $y = ax^2$ can be obtained from the graph of $y = x^2$, where a is a number greater than zero for: a. $0 < a < 1$ b. $a > 1$

Students are able to do the first part of the problem alone but need guidance to make the transition to the more abstract parts. After the functions are graphed most groups ask what is meant by questions 2 and 3? What is expected of us? For step two I encourage each group to discuss the effect of the coefficient and to write their findings. For step three I tell them to generalize what the have just learned. Most students complete the activity without confidence in their understanding. The major benefit comes later when transformations of other functions are discussed. The student realizes what should happen to the other functions because he/she retains the knowledge learned by discovery. As one student told me, " I just see it as all the same except that the function changes."

COMPUTERS AND THE INTERNET

Middlesex County College currently offers computer assisted instruction for Basic Mathematics and Elementary Algebra. The courses are taught by an instructor in conjunction with Academic Systems interactive software. The student hears the lesson using headphones. The student is asked to interact many times during the lesson and at the end of the session takes a test on the material presented. The instructor receives the test score and decides if the student needs personal attention or is able to proceed to the next lesson. Preliminary results show that although the passing rate in courses using the computer is unchanged compared to traditional courses, students using the computer are receiving higher grades. The role of the instructor is different in computer assisted instruction. The instructor interacts one on one, or in small groups with the student. Student reactions to the class are mixed. Students who felt the course would be easier than a traditional course invariably did not do well. Positive comments from students were that they liked working at their own pace and could go back to redo anything that they did not understand. One main negative comment from students was that they missed the classroom atmosphere where they were able to ask questions and interact with an instructor.

This semester Middlesex County College will be offering courses on the Internet. Computer assisted and Internet courses are being offered to allow students who prefer to work on their own a choice. These courses are probably for a small portion of the student body, but are necessary to give all students the opportunity to achieve success using all feasible learning styles.

CONCLUSION:

With any new paradigm in education there is controversy. Some questions are: is the material being covered, is technology used as a tool or being relied on by the student, and how is group work evaluated? These are legitimate questions and must be constantly reevaluated. The key, I believe, is the education of faculty. Workshops are needed, not on how to use the calculator, but how to effectively use it in various mathematics classes. Workshops on teaming that are relative to one's discipline are necessary. Time must be set aside to allow faculty to discuss and exchange ideas. We must not be afraid to break from tradition and try new approaches. If some material is not being covered because of teaming activities, then we must reevaluate our curriculums. At a recent seminar, I remember asking "How can we use teaming activities and still cover the material", Karl Smith replied that it depends on who is covering the material and who is learning the material. In conclusion I would like to share comments I have heard from students after classes that contained non-traditional instruction: "I never knew math could be fun.," or "I finally understand math."

CARING, COMMUNITY, AND TRANSCENDENCE: DEVELOPING SPIRIT TO IMPROVE LEARNING

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Fortunately, American colleges and universities have escaped the school violence carried out in Arkansas, Oregon, and Colorado in 1998 and 1999. Institutions of higher education, influenced by cultural changes, play less of a parental role than they did thirty years ago. However, faculty regularly see disaffected, lonely, isolated, and fearful students pass through our classrooms every year. Many of us concentrate on the subject matter, believing the alienation of students not to be in our domain. However, faculty members have opportunities, because of the intense relationships that develop over a semester or a year of study, to influence students personally, even as our primary goal remains to help them master a field of study. Some faculty disdain becoming involved in the students' emotional or spiritual lives, while others embrace any opportunity. The primary purpose of this paper is to discuss how faculty can and do develop a *spirit* in the classes they teach and thus become more effective teachers.

Spirit has numerous definitions, including religious, sacred, and moral ones not directly applicable here, but those useful for this paper are "the breath of life" or "a character, disposition, or temper peculiar to and often animating a particular individual or group." Of course, once we use spirit, we can't ignore the adjectival form *spiritual*, the first definition being "of the nature of spirit rather than material." Another useful definition is "related or joined in spirit: spiritually akin: having a relationship one to another based on matter of the spirit."

These definitions, all from *Webster's Third International Unabridged Dictionary*, point to the essential problem of this paper, expressed eloquently by the Buddhist scholar Edward Conze, "Spirit is non-sensuous and we have no sense-data to work on. In addition spiritual actions are disintegrated when reflected upon. If they are not to lose their bloom, they must be performed unconsciously and automatically" (23). However, he argues that since it is the *spiritual* aspects of life that breathe meaning into it, "It seems rather stupid to discard the life-giving qualities of these realms simply because they do not conform to a standard of truth suited only to the natural world, where to the scientist phenomena appear worthy of notice only if they are capable of repetition, public observation, and measurement" (24). So despite the lack of hard data about student performance or even descriptions of repeatable techniques by teachers, I will proceed because I am convinced, like Conze, of the importance of the spiritual aspects of life, particularly that aspect that concerns us here: teaching and learning.

Perhaps a more traditional way of speaking about the spirit of a class would be to say the feeling or the affective qualities of a class. I became aware of different feelings in classes as a participant in a faculty development program called first the New Jersey Master Faculty Program and later Partners in Learning in which faculty pairs sit in each other's classes over at least a semester and sometimes a year. (For a full description of this program, see Katz & Henry or

Smith & LaCelle-Peterson.) These pairs focused not on the performance of the teacher but rather on the response of the students to the teacher. In addition to the observations, each partner interviewed students in the observed class. Although these interviews could follow any number of themes the basic focus was, "How do students learn?"

For this paper I followed the same mode of inquiry as outlined by Katz and Henry, sitting in on classes, not just once but many times, both at a community college and at a university. I interviewed faculty from all types of colleges and universities and interviewed students from the classes that I perceived to be imbued with a breath of life, a spirit that not only supported learning but also the students themselves. From these observations, I determined three qualities that gave these classes that spirit, that breath of life: caring, community, and transcendence. These three serve as an antidote to alienation, isolation, and fear, more common motivational tools that tend to distort rather than nourish true learning.

Caring:

Parker Palmer begins his book *The Courage to Teach* with a quotation from a Rilke poem, "Ah, not to be cut off,/not through the slightest partition/shut out from the law of the stars." But competition for grades, placement on bell curves, emphasis on being the best do tend to "cut off" marginal students, and even the best ones may feel too pressured to feel anything but anxiety.

The first night I sat in on Professor A's writing class, I felt as if no student, or even an outsider like myself, was cut off from the group or the subject matter. I intended to stay for only sixty minutes as the class began at the inconvenient five o'clock hour, but what I experienced made me stay longer. Professor A introduced me, made a few personal remarks, and then began by asking students to find points of comparison between two texts on nature. Students came in late, hurrying as if from work. She made no comment, certainly no criticism, but continued with the analysis, praising students for each insight. The subject matter wasn't unusually interesting—I had taught the same course almost a hundred times myself—but I felt so good being there. Joe, behind me, made a comment about not being able to understand how others could see so much in a text and said he wasn't smart enough to do it. Candy, in the front row turned to him and says, "Of course you are smart enough." I didn't leave; I even returned after the break.

What is the mystery of this professor? The one thing that I could name was that students felt cared for, even loved by her. Candy's casual remark to the floundering student most likely emerged from the prevailing feeling of the class: that everyone there is smart enough. Professor A's ignoring the late students comes out of her wanting everyone to feel comfortable, to be safe to learn.

In several of Professor A's classes that I attended, a student who had been unusually successful that week would read his/her paper. Early on a female student read a paper on the medical profession that included her bout with cancer. The student's voice cracked twice while she was reading. Students commented on why the paper was good, but no negatives were offered by Professor A or her students, a pattern that continued in less personal papers. (I did look at Professor A's written comments, and there were both positive ones, and recommendations for change.) Two things struck me: that students felt safe enough to expose personal issues and that Professor A imbued the students in all sorts of ways with confidence that they can learn to write well.

In interviewing her students I found that they did feel cared for and supported. One student who had an A going wrote a B paper and had decided not to do a rewrite because she found the paper too difficult. Professor A said in a disappointed way, "Are you sure you won't rewrite? I know you can do so much better." The student reported feeling cared for, so with just that little encouragement, she did the rewrite and maintained her unmarred A.

Another student spoke of Professor A's ability to direct students. Professor A "focuses on an individual and gives you an undivided moment that you can take with you and learn from." I was struck with the words "undivided moment" and speculate that it is that intense individual attention that Professor A is able to give both in and out of class that makes her such a successful writing instructor. Since her attention is so focused, she can see what the individual needs and give the help necessary. But giving an undivided moment is also an act of love.

Professor B's Interpersonal Communication class sat in a semi-circle that grew as students come in. He walked in a few minutes late, greeted me, then joined the semi-circle, talked with the student next to him, was silent for a moment, and began the class by asking if anyone has anything they would like to report. He asked that they follow the usual procedure of saying their names in case someone didn't remember. Andre reported that he has been named in one of the Who's Who listings; Craig said that he finally got up enough courage to see his grandmother in the nursing home, that she looked terrible, but he was glad he went; Wendy said that she finally told her aunt that whether she continued in school or not was none of her aunt's business. Students responded, "Good for you," and other encouraging remarks; then silence prevailed until the next person spoke. Professor B sat with a pencil and paper as if taking notes. He glanced up as each person began to speak and after each finished, but while anyone spoke, he looked at his paper, made some markings, and said nothing.

Why does Professor B just look at his paper rather than at the student who was speaking, I asked my informers? One believed that he doesn't want the students to read approval or disapproval into his expression, that they should speak because they have something to say. Another, a young man named Chris, said, "Teachers looking you right in the eye is scary. I have the feeling this guy is eyeballing me, and he is going to prove me wrong and pound me into the ground. By not having that steady beam, you can feel more comfortable."

Not surprisingly, students report caring for students as one of Professor B's strengths. One of his students reported that he "listens with his entire self." This comment surprised me since Professor B doesn't look at them while they are speaking in the group, but I noticed that he did when speaking to them individually. Students have his undivided attention for a short time, even though his attention is very different from that of Professor A, who does look at students directly and does have an approving look on her face. Critics could argue that the examples of Professor A and B aren't typical because the subject matter is "soft"--just communication--and lends itself to the feeling realm.
That description might apply to Professor B, who teacher Interpersonal Communication, but certainly not to Professor A, who has a traditional academic background, writes grants, develops web courses, and at the same time is demanding of students in a traditional way.

The third professor whom I determined to have unusually good spirit in her class teaches mathematics. I observed statistics and calculus, both of which had two lectures and a lab. In the lecture Professor C used a combination of lecturing, doing problems on the board, and having students do problems at their seats. Students reported liking her presentation style, which is lively and interactive. They also enjoyed her practical examples, such as her handing out a newspaper clipping in statistics that showed the percentage of error possible in the political poll it was reporting.

But what about caring? The amount of work she collected and returned indicated she was willing to work as hard as they were, a quality I also observed in Professor A and students reported for Professor B. Richard Light in his report on *The Harvard Assessment Seminars* "The big point—it comes up over and over as crucial—is the importance of quick and detailed feedback" (31). Professor C also often demonstrated her investment in their success. At the end of one of the statistics classes, when Professor C had returned some exams, she approached one student and said that she would like him to come to her office to go over some of the things he didn't understand on the exam. "Would two o'clock today be good?" she said, not leaving it to him to make an appointment. Thus caring can be communicated, not only by affect, but also by simple hard work.

Jennifer, a young coed who looked as if she might be a model and had an A in calculus at midterm, liked Professor C's casual attitude "She doesn't seem overpowering. If she makes a mistake, she jokes about it." The student then commented about the respect she had for Professor C, and said that Professor C also respects students, a theme that runs through the student interviews for all three professors.

One young man who wanted to be a physicist seemed very emotional in the calculus lecture, sitting in the front row and wanting to be sure he understood every problem. He previously had to drop out of school, and success was important to him. He reported that one thing he liked about Professor C was her ability to recognize what students needed. Twice she stayed after class when he needed help, and he didn't even have to ask her to do so. "She seems to have a sense when someone needs help." Another time in lab he was struggling with a problem on the "chain rule," an important calculus concept, and becoming upset with his inability to understand it. She said to him, "Do you want me to stay and help or go away?" He asked her to go away because he was too emotional to think clearly. Later he went back to get help, but he was impressed that she gave him the choice. Students in both calculus and statistics freely admitted their errors in front of other students, much like students did in Professor A's class, indicating to me that this was a safe place to learn.

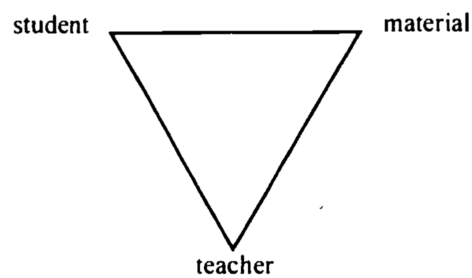
Although I cannot say that Professor C's lecture classes kept the students or me on the edge of our chairs, she did not allow herself to get locked into the form of "lecture," where teachers do all the talking (in contrast to "lab" or "precept" where students talk). Although she did most of the talking in the lecture, working out problems on the board, she constantly checked back with the students to see if they were following her or if they could do the next step. She also asked students to do problems, alone or in pairs or threes, and, occasionally, wrote out mathematical explanations. The classes that I observed, both at the community college and the university, that were strictly lecture, where no student response was expected or given, had very little spirit in them, and, in fact, students sometimes slept. These lectures, content laden and competently done, did not apparently connect with the students enough to breathe life into the class. I am not asserting that lectures, with no audience interaction, can't enliven people—ministers would be in trouble if they couldn't—rather that I did not see any in the one hundred and fifty or so hours of class I sat in on for this study.

What about larger classes, say one of a hundred to three hundred? How could professors care for so many students? Although this is a significant problem, Karl Smith, an engineering professor and expert on cooperative learning at the University of Minnesota, whom I interviewed for this paper, has developed one technique. He forms student committees in each class for handling student issues, and he meets with that committee on a regular basis throughout the semester. Most problems that come up have to do with bureaucratic matters, such as changing dates of exams and projects to avoid conflicts with others, but students do have a forum for being heard.

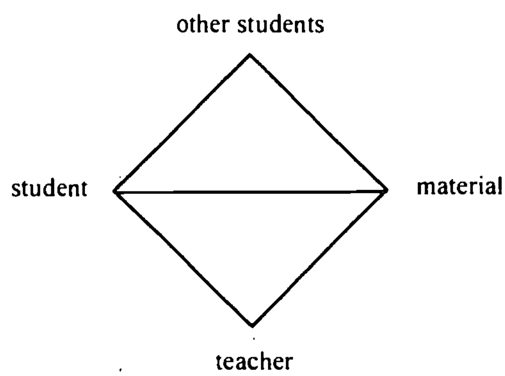
Caring for the needs of students, providing a setting in which they can learn, takes many forms. We see in the above examples some of the ordinary practices extraordinary teachers at any level do: giving encouragement and positive feedback, providing a safe environment in which to speak, and returning work quickly with detailed feedback. One additional quality that prevails in the classes of Professors A, B, and C was an intense attention to individual students, "an undivided moment" to make them feel recognized and supported, and it is this quality that I believe contributed significantly to the spirit in the classes of these three.

Community:

The most basic connection in the teaching-learning situation, especially at the college level, is between the student and the material. In some situations, such as in correspondence or web-based courses, the student and the teacher may never meet. However, most students, particularly younger ones do not have the motivation or perseverance to stay with the material without some sort of community to provide support, guidance, motivation, or even inspiration or threat that is usually provided by a teacher. Therefore, we might picture the classic teaching model as an upside down triangle with the triangle with the teacher supporting the deepening connection between the student and the material.



Although a three-legged table is infinitely more stable than one with just two legs, we also know that one with four legs is what is needed to stand the pressure of every day life. So it is in the classroom, and the fourth leg, I propose, is the other students.



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In this model I am still most concerned about the students developing competency with the material, but now the student has not just the support and guidance of the teacher, but also of his/her colleagues in the class. I believe it is this connection that is most ignored in college teaching and the one that has the most potential for changing not just the learning, but also the feeling, i.e. the spirit, in a college classroom.

Some of the teaching techniques that help develop community in the class are group projects, debates, group quizzes or tests, and class presentations. In the last ten years numerous books and articles have been published on cooperative learning, Karl Smith and Barbara Millis having written some of the best. Based on the work of Johnson and Johnson at the University of Minnesota, they outline careful procedures for forming groups and assigning work so that students experience a benefit for working in groups, called positive interdependence, but are still individually accountable (Johnson, Johnson & Smith and Millis & Cottell). However, neither Professor A (writing) nor Professor C (statistics and calculus) follow all of Johnson and Johnson's recommended procedure for using small groups, although certainly they foster positive interdependence. Professor B (communications) uses small groups only in very specific ways and relies primarily on self-disclosure as a vehicle for building community. There is no single ingredient necessary for developing a sense of spirit.

Small Groups: The way both Professor A and C formed groups seemed to be influenced by the their respect for the students as equal adults and their concern that students be comfortable in class. Neither teacher has any special seating arrangements. In Professor C's statistics class, for example, two students sat way in the back of the room, three rows behind anyone else. Neither Professor A or C commented nor reacted negatively when students came in late. Both, however, focused on what they wanted the students to learn. In some of the many classes I sat in on for this study, there were vast amounts of information, but it wasn't always clear what was essential and what was merely interesting. In these two classes it was: Professor A reported she finds "the North Star," a term from Rollo May about the importance of focusing on a significant concept and relating lesser ones to it, and keeps the students' eyes on it.

Not surprising both formed small groups rather loosely, letting students work with whom they wished. Professor C's calculus class met in a computer lab. The lab assignment for one day I observed was to determine how long it would take a raindrop to fall from the height of 3,000 feet. Most students formed groups of three, each group working around one computer, but in the center of the room were four students, sitting next to each other and talking occasionally with each other, but mostly working alone. Professor C said that she didn't want to require that student specifically work in groups after the initial assignment, but she did want them to consult each other. She wasn't willing to force students to stay in a situation in which they weren't entirely comfortable, but all were accountable for knowing the laws of falling bodies.

I interviewed one of the students sitting in the center row where the four students worked and asked him why he liked working alone. He said the main reason was he could finish his assignments at three o'clock in the morning if he wished, but he implied that he really did not like working alone but feared asking students to work with him. He sat off to the side in the lecture, and on some days paid little attention. Initially, I wondered if he were failing, but just the opposite was true. He often understood the lesson so well that he didn't need to pay attention to Professor C's explanation of the problems. He also said that he would enjoy helping other students with problems if he were asked. So here is the irony: one of the qualities—making students feel comfortable—that Professor C relies on to create the spirit of the class may work against the best possible results. If she assigned this student to a group, he would feel more connected, and because he understands the material so well, he could help less competent students learn.

Jennifer sat at a computer between two young men she knew from other classes. They also sat near each other in lecture and compared answers to problems, forming their own community. She reported they met outside of class every week to be sure they understood the concepts for that week. Uri Treisman, who won a McCarther Award for his tremendous success in teaching calculus in groups to types of students who previously had high rates of failure, uses assigned, stable groups throughout a semester. Of the students in Jennifer's groups, she earned an A, one man a B, and the other a D. Although a D doesn't sound like a good grade, Professor C said she doubted that student would have passed without the support of the group. Here we have an unanswerable questions: Was it the ease and comfort of Professor C that allowed this and other groups to form and flourish? Would Professor C lose the spirit that exists in her class if she insisted that all students belong to a semester-long group?

Professor A also has very loosely formed groups, and commented when I questioned her about them, "If they are working, why should I interfere." Professor A tells a story about how she uses small groups. For a writing class David wrote an in-class analysis of a John Donne poem "The Bait," interpreting it to be literally about fishing. She failed the paper, and when he challenged her on it, she didn't react or say that he was wrong, but rather asked if they could leave it up to the class. When the class sided with her, she let David select another poem to write another analysis. Here is what she said about David's case:

> I felt bad for David. At the same time there was something funny about it—which I would never share with the class. Fortunately, he cared, and something about the group caring carried him. That is something I think I know how to do. I give the groups tools—the way in. They can't just say, "that's good" or "I like that." They really have to know what kind of feedback to give him. As part of the assignment, students could only consult their group, so they had to help him, and he had to sit down by himself and

> write the blue book. I know how to use groups like cheerleaders; it is almost like watching a team—they are cheering a person on; they really want that person to do well. The class becomes a coach. Also I respected David for taking my challenge of saying, "Can we show this to the whole class?" He was so sure he was right; he was so close-minded, but he took the challenge. I knew I was setting him up because I knew how bad the essay was. I guess I was being a phony, and that added to my sympathy for him.

Professor A knew what she wanted: to teach David to understand the concept of metaphor. She did that while using the community of the class and his own small group, and most importantly allowing David to save face.

The point here is that teachers can use the class as a community to support learning. These two faculty members use loosely formed groups, because for them student comfort is a high priority. The safe feeling made adherence to the accepted rules of group work unnecessary. I suspect another reason they are both successful is that they have set up such clear goals--North Stars--for student learning. Professor A taught linguistic and rhetorical systems, Professor C specific concepts in calculus and statistics.

Professor B, the communication instructor, requires that students sit in a circle. In one evening class that I attended students began moving chairs to make a large circle, leaving the extra ones in the middle. He insisted not only that those chairs be removed, but also that the circle had to be moved in so that students sat close to each other. That evening he used an Awareness Wheel, described below, forming a circle within a circle. His configurations facilitated communication and community. It also supported self-disclosure.

Self-disclosure: Although Professor B uses self-disclosure as a primary mode of instruction, Professor A also makes sure students get to know each other. On the first night of the writing class a student reported that she asked students to tell where they are from, where they are going, and how they see this class fitting into that plan. Students could interpret those instructions in a variety of ways, but they had to construct a little "life story," making them known to each other from the first class. Many classes had students give their names on the first day of class, but few encouraged further self-disclosure.

Students in Professor B's Interpersonal Communications class had been asked to complete Awareness Wheels about difficult issues in their lives. Miller and Miller in their book *Core Communication* describe an Awareness Wheel as a "map of an issue," the "underlying structure" made up of "basic parts—sensory data, thoughts, feelings, wants, and actions" (41). Each of these parts are "distinct yet interact with one another," and "are present whether or not your are conscious of them," Miller and Miller claim. Professor B put a cloth copy of such a wheel, measuring about two by three feet, on the floor. The word *issue* was written in the middle with *sensory data, thoughts, feelings, actions,* and *wants* (self and other people) written in sections around the word *issue.*

Professor B asked if any student would like to play out one of their issues in front of the class. Immediately, Denise jumped up and stood on the word *issue.* Five students from the class volunteered to sit around her to be prepared to ask her questions about the points on the wheel: each student was responsible for sensory data, thoughts, feelings, actions, or wants, if he thought she had not considered any aspect adequately. Professor B slid easily to the floor in the midst of the other students. The issue was that Denise would fail German if she did not get an A or a B on a test that was to be held in about forty hours, and she had to sleep, work, and attend class for most of that time.

She explained how she happened to find herself in such a vulnerable position, giving up blaming the institution (there had been a change in teachers) and the new teacher (it had been made clear what she had to know). She did not perceive herself as a victim, something I suspect this class had helped her come to. She talked about wanting not to disappoint her parents, particularly her father. When she discussed her action, she determined that she would probably have to sacrifice working although she hated to disappoint her boss. Students were then encouraged to ask her questions about one of the specific areas around the issue. Professor B. gently cut off any student who gave advice or who digressed from the issue. Here he was sitting on the floor, directing the drama, carried out in concentric circles around Denise. Several students seem eager to "advise" her not to go to work, but Professor B demanded ever so kindly that the role of the class was to confirm that she understood all aspects of the issue, not to decide for her.

The subject matter of the class was a theoretical model for decision making. Denise and the class acted out that model before us--how could they, or I, ever forget it--on an issue that had immediate consequences for Denise. After revealing her dilemma to the class, she must have been able to feel the class members' support for her. Self-disclosure helped solidify the community of the class; at the same time students learned the content.

Another assignment that requires self-disclosure in Interpersonal Communication is the "bag share." Eric stood before the class and began a "bag share," telling the class about himself and showing objects from his "bag," which represented aspects of his life. Eric ended a story of parental support-- passes around pictures—fraternity life—showed a paddle inscribed with Greek letters--school failure and alcohol abuse, with on a goal for the future: "I want to be a journalist." Professor B responded, "I look forward to reading your editorials." Louise told her story, including her parents' divorce, crying twice during her talk. Later she apologized for being a "sap." Professor B said gently, "Don't apologize, the tears are a part of who you are." Professor B asked students to write a response to each of the presenters and, if possible, to speak to them personally.

What is the point of so much self-revelation? Wisely and Lynn, authors of a chapter in *Spirit at Work*, argue for storytelling, especially personal stories in leadership education because they "create conditions of openness where more formal procedural efforts have failed." They argue that an audience "suspends disbelief" and by doing so becomes open to the "veracity and perceptions of others: we listen and attend, instead of merely awaiting our opportunity to challenge the speaker. A special kind of space opens up....The climate thus created allows people to make connections between their experiences and to discover their common humanity in new ways, at deeper levels" (107).

Students certainly believed that self-disclosure helped them understand themselves as well as make connections with other students. Two of the students I interviewed said that the bag share had been the most important college project they had ever done. One student made a video that included TV images that were important symbols for him.

Students report that sharing so much information about their lives makes them feel more connected on campus. They enjoy meeting other members of the class on campus because it wouldn't be just a "hi," but a real meeting as they knew so much about each other. They felt a connection that supported them in the classroom and beyond.

Transcendence:

Transcendence offers another semantic difficulty because of its philosophical and metaphysical meanings; however if we use the first definition in *Webster's Third International Dictionary*, the quality or state of "going beyond or exceeding usual limits," we have a good start. But what are the usual limits? Some classes I observed were very factual, and the assignments and examinations dealt mainly with those facts. Others *transcended* the facts, as seen above in the discussion of Professors A, B, and C by bridging the gap between the larger world and the student's world. Wisely and Lynn write, "Community or our capacity for relatedness, is crucial to education. We learn by relating ourselves to a larger reality, one that includes other people but also...nature, history, thought, and spirit" (105).

The most basic way professors teach beyond the facts is by making the material practical or relevant, either for the present or the future. Professor C made both statistics and calculus practical when possible. Professor B's Interpersonal Communication class used on-going student issues as the material for the class, applying theoretical models to deal with that immediate material.

Subject matter also becomes transcendent when it is seen as part of a long history. Professor C gives the mathematical background when presenting a new topic. Some problems, such as finding an instantaneous rate of change, were ones the Greeks confronted and were not answered before Newton developed the calculus. Professor C points out to students that calculus opened up the possibilities for technology and is a forerunner of the industrial revolution. The formulas become, when put into their historical context, less things to be memorized, than important knowledge to be integrated into an understanding of the intellectual history of humankind. Even in skill classes, Professor C points out, "There is a larger picture to math that I hate to have them miss out on."

However, the main way that class becomes transcendent is when the student can see some aspect his life story connected to the material of the class. Professor A, the writing teacher, does this every semester for her research paper assignment. The paper requires that students research a topic connected to one of the texts read during the semester, but she often stretches the topic so that the student can write on whatever he is dealing with at the time. She reports,

> If they are having trouble, I will help them adjust their texts so they can address their problems. Once I had a Pakastani student who was divorced and had a child, and she was having a problem within the confines of her culture. She enjoyed reading feminine critics about Ophelia, about her boundaries and her inability to fight the system. She found it a relief to read critics, to find that her feelings of oppression were correct. She realized she had more options in our time period than Ophelia did in hers. So I will give them options for their research papers, either in fiction or non-fiction so that they can deal with their issues in text.

The Pakastani woman, as well as some of Professor B's students in Interpersonal Communications, could have dealt with their problems by talking to friends and fellow students or even by consulting a therapist. Wisely and Lynn see another place for our stories: "Whereas therapy (appropriately, for its purposes) turns us back on our own story, education opens our eyes to a larger context for that story. In relating our experiences to that larger context, we may also begin to perceive that our relation to one another extends beyond the tasks of the moment or the psychological economy of the workplace [or classroom]: that we have something called 'spirit' in common" (109).

I was struck by the power of personal stories in a Writing-Across-the-Curriculum seminar that I conducted some years ago. I asked the group members to write a paragraph or two about why they had chosen the field they were in. A mathematics teacher in the group wrote about her discovering the order of mathematics gave her a way of ordering her own life, which up to that point had not made much sense to her. It never occurred to me before that one would chose mathematics for deeply personal reasons, although I knew that I had chosen literature as a major because I wanted to talk and write about big human issues, mainly the meaning of life. However, it did occur to me, as I listened to the mathematics teacher, that we should be telling our stories to our students. Peter Senge writes about business leaders using their personal stories as a way of forming a common vision for the people they are leading. Although teachers and CEO are not the same, both can be inspired to use their personal stories by Senge's words:

> The leader's purpose story is both personal and universal. It defines her or his life's work. It ennobles his efforts, yet leaves an abiding humility that keeps him from taking his own successes and failures too seriously. It brings a unique depth of meaning to his vision, a larger landscape upon which his personal dreams and goals stand out as landmarks on a larger journey (346).

If we are to teach students, we must not treat our subject or their lives as small. Rather we must transcend littleness, inspiring students to learn how their lives connect with the big drama that has been marching forward for at least three thousand years.

I began this paper with the problem of violence in the school because I see violence being exacerbated by alienation, which is the opposite of the spiritual. Vaclav Havel speaks eloquently about a need for a shift in spirit and predicts a cataclysm if there isn't one. Although his statement is not directed particularly at the educational community, his urgency seems applicable: "Consciousness precedes being and not the other way around as Marxists claim. For this reason, the salvation of this human world lies nowhere else than the human heart, in the power to reflect, in human meekness, and in human responsibility. Without a global revolution in the sphere of human consciousness, nothing will change for the better in the sphere of our beings as human, and the catastrophe toward which this world is headed—be it ecological, social, demographic or a general breakdown of civilization—will be unavoidable" (qt. in Palmer, "Leading from Within" 21). Effecting a revolution in human consciousness is probably not a job description most faculty would find palatable, but perhaps many would attend to the *spirit* in the classes they teach if they thought it were possible or could be convinced it had educational value. And I am arguing that it does.

Faculty should not be concerned about alienation just to stop school violence: They should be concerned because alienation impedes learning. The three college teachers described here all worked against alienation by caring for their students, forming communities in their classroom, and elevating their subject matter beyond the mundane. Their classrooms were places where spirit, that elusive quality, visited and sometimes, in magic moments, even prevailed.

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ACTION METHODS FOR TEACHING CULTURAL DIVERSITY AWARENESS

by

Dan Tomasulo, Ph.D.

It is not the same to talk of bulls as to be in the bullring.

Spanish proverb

This paper will be devoted to the description of action methods which can be used to provide a practical understanding and awareness of culturally diverse material. It will draw from such varied disciplines as cross cultural psychology, international business, and sociodrama, with the goal of suggesting a methodology for using role playing to teach ethnic, social, racial, religious, and cultural differences across the curriculum

For a variety of reasons our need for understanding culturally sensitive values has mushroomed in the last several years. The advent of the world wide web and instant language translations have simultaneously shrunk our world and made the understanding of other cultures a necessity. To hit closer to home, from an American perspective we appear to be on the brink of experiencing what Harvard sociologist Daniel Bell (1976) had identified more than 20 years ago as a weakening of America's infrastructure through (consumer-driven) individualism. What has worked for us in the past appears to be in need of a change. The prior success of the division of labor combined with the staunch individualist approach of Americans must evolve to a type of voluntary integration. If we don't learn what is important to others we cannot attain what is important to us. Indeed, the individualist approach of any culture would seem to be in need of such an evolution. The arrival of the age of information has forced a communal process to emerge in the wake of individualism. The rapid dissemination of information allows people to learn and know things that happen on the other side of the globe instantly. The problem appears to be not in the translation of the information, but rather in the functional interpretation and understanding of it. To quote Fons Trompenaars and Charles Hampden-Turner(1998):

> "The extension of the division of labor would cause the individual to share fewer and fewer characteristics with other individuals ...and would call for a new form of ... biological-type integration as found in developing organisms, which are both differentiated and integrated...[a] necessary synthesis of individualism and communitarianism in increasingly complex, differentiated and interdependent societies."(Pg. 58-59).

Consider the recent economic turbulence in Asia resulting in the US stock market's negative reaction, the so-called "Asia flu" response by Wall Street. The domino effect of world wide markets was halted once the problem was reinterpreted as a "domestic" issue for the Pacific Rim rather than international issue. Alternately, the US stock market not only recovered, but soared in this reinterpretation and reorientation to our own domestic issues. Approximately 2 months after the "Asian flu" struck, the US posted record gains in the technology stocks and the Asian market swelled. This prompted Nikke officials to say "thank you" to Wall Street. While the jury is still out on the Asian economic crisis, the point is that this mutuality of responses can be seen as an example of the type of synthesis to which Trompenaars and Hampden-Turner refer.

A glance at today's New York Times will show that multi-cultural issues are woven into the fabric of our daily existence. While this has probably always been true, it appears that the investigation and understanding of different cultures is currently center stage for social, developmental, and organizational psychologists. This may be particularly true for American psychologists. The twenty- fifth anniversary of the International Association for Cross Cultural Psychology (The IACCP is considered central to the development of cross-cultural psychology) was held, for the first time, in the United States in August of 1997. Last year, the October issue of the American Psychologist's lead article was titled: Cross-Cultural Psychology as a Scholarly Discipline (Segall, Lonner, & Berry, 1998); and this year a new program, The Solomon Asch Center will open this summer At University of Pennsylvania for the study of Ethnopolitical Conflict.

As a psychologist teaching at Brookdale Community College over the past 20 years has I have witnessed increasing presence and impact of diversity issues on campus. Life span texts are now rich with child rearing, spiritual, and social practices across cultures. Racial and ethnically polarized topics are regular fare brought to the college by various speakers. The problem does not seem to be the range and depth of diversity information. However, it seems that the functional aspects of comprehending diversity issues are often eclipsed by the sheer volume of material needed to be covered.

In business and politics the understanding of culturally sensitive issues has become a necessary means for survival. The merger of Chrysler and Mercedes, multinational space programs, human rights violations in China and Yugoslavia, culturally sensitive issues before the Supreme Court, are but a fraction of what we are besieged with on a daily basis. Business, the arts, religious freedom, politics and world peace are affected by our understanding of other cultures.

Or lack of it.

Recent headlines are case in point. NATO strikes against Yugoslavia have forced us to peer again into the dynamics of another culture. A few months earlier, the bombing of Saddam Hussein was a highly organized, strategical strike sanctioned by the United Nations requiring the use of precision weaponry and coordinated military efforts. In that effort, four days of bombing military targets central to Hussein's chemical weapons capability were carried out. The seemingly sudden decision to bomb continuously for this exact number of days was, at least in part, due to a timetable that few Brits and even fewer Americans understood. The four days of bombing had to end because of a culturally and spiritually sensitive issue. The onset of Ramadan, the highest of holy days in the Muslim religion. We simply did not want our missiles flying over allies during their religious holidays.

In preparing for this paper I found ample material available on "diversity" issues within business and educational organizations along with studies concerning cultural values and the above mentioned issue of individualism- communitarianism (Triandis, 1995; Smith and Schwartz, 1997; Kagitcibasi, 1997). However, while many curriculum based references were found, only a handful of exceptions (Hui & Luk, 1997; Bhagat & Landis, 1996) devoted their material to actual training methods. I wanted something with some "nuts and bolts" hands-on training that would lend itself to an exploration of methodologies used. In other words, I wanted to find material on *how* diversity could be taught rather than *what* would be taught. For this I went to a more applied setting. I used business contacts involved in diversity training for managers in various countries and asked to view their training materials. This led to a reference which, as far as I can tell, has become the bible for managers working in global business. I decided to use the text *Riding the waves of Culture: Understanding Diversity in Global Business (Second Edition)* by Fons Trompenaars and Charles Hampden-Turner(1998) as the basis for my understanding issues central to diversity training. What is particularly useful in using a business application is that it moves the need for cultural awareness from the abstract to the concrete. My goal is to amplify the principles outlined by these authors through the specific use of selected action methods. The purpose of doing this is to make the learning process more experiential by extracting greater understanding and increase competence in settling culturally sensitive dilemmas. This example places the cultural issues in such a way that they need not only to be understood, but reconciled. The pragmatic basics of business and politics will serve as a vehicle to demonstrate these methods. Readers should extrapolated from these examples ways in which the methodology can be used in their particular discipline.

The authors draw on five relational orientations originally proposed by Talsott Parson (1951). These are:

- Universalism Vs Particularism (Rules Vs Relationships)
- Communitarianism Vs Individualism (Group Vs. The individual)
- Neutral Vs Emotional (The range of feelings expressed.)
- Diffuse Vs Specific (The range of involvement.)
- Achievement Vs Ascription (How status is accorded.)

While these authors do not mention the use of role-play or other action methods as part of their training the emphasis on using these experiential techniques seems consistent with the goals Trompenaars and Hampden-Turner have set out:

> "Transcultural effectiveness is not measured only by the degree to which you are able to grasp the opposite value. It is measured by your competence in reconciling the dilemmas, i.e., the degree to which you are able to make both values work together..." (Pg. 46)

Historically Moreno (the founder of group psychotherapy and psychodrama) identified the use of action methods to study racial, spiritual, or cultural issues as "Axiodramas". While this term is useful to describe the arc of the present topic, I wish to introduce a more specific term relevant to an action method used for cross-cultural investigations. This term is a "cultural double". It is used throughout the paper to highlight the specific function of this method and to distinguish it from other types of "doubling" often used in the clinical aspects of psychodrama and sociodrama. A second shift in the use of terminology is using the phrase "Split Double" rather than "Paired Double." Although paired doubling is often used to highlight and identify conflicting perspectives or ideas the use of the term "split double" may more accurately define the chasm emphasized in an internal dialogue between an individual and his or her culture. Finally I believe it will be helpful to use descriptors like "primary protagonist" and "secondary protagonist" to more easily determine whom is being spoken about.

The double is an action method which is typically used for three main purposes(Tomasulo, 1998): providing emotional support , giving emotional expression, and reorganize perceptions. While all three are important the "cultural double" will be devoted to the reorganization of culturally sensitive perceptions. Standard doubling and aspects of the "split double" (represented by the term 'other double' when graphed along side the cultural double) will encompass the support and expression elements. The position of the double is directly behind the protagonist. For our purpose the protagonist(s) will be those immersed in the negotiation directly. This may be a dual protagonist situation as in a simple distributive bargaining, or something more complex as multiple protagonists in integrative bargaining situation. In these instances it may be helpful to identify a "primary" and "secondary" protagonist (referring to them this way for naming purposes only, not status.) In a mediation or arbitration exercise it may be valuable to label the mediator or arbitrator as the protagonist, and the positions represented by others at "auxiliaries". Such differentiation will allow for greater clarity when assigning doubles. It is best to think of the standard double as a person who

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understands the protagonist's thoughts and feelings. The most reliable conditions for standard doubling (not necessarily for the cultural double) occur when you allow the protagonist to select his or her own double. The protagonist will know best who to pick because of what is known as "tele" (the natural connections and understandings between people). Here the protagonist is asked: "Who in the class do you think understands your thoughts and feelings about your position best?" Alternately, a member of the class may volunteer to be the double. As a third option the facilitator may chose the double and in fact, the choice of a cultural double may be assigned to a trained auxiliary (someone specifically trained in the procedure, perhaps a TA who knows the culture being encountered) or to another member of the class the facilitator knows or suspects has knowledge of the culture. It is also possible for the protagonist to double him or her self. To recap:

- the protagonist may select someone from the group they think grasps how he or she feels;
- a class member could volunteer for the role;
- the facilitator could select a member from the group you believe understands the person;
- you may have a trained auxiliary in the class you could use as a cultural double;
- and the facilitator could do the doubling (either as a demonstration, or directly if no one else seems appropriate.)
- If all else fails and none of those alternatives are feasible, the protagonist can stand behind the chair and double himself or herself.

In each case the feeling of the protagonist is trying to be identified by the double. Toward this end, have the member from the class who is to be the double stand or sit directly behind the protagonist.. Once in the role, the facilitator may ask the double how he or she thinks the protagonist feels. It may be necessary for the facilitator to prompt the double to speak in the first person in order to reflect the protagonist's feeling state. The facilitator can do this by cueing the double to say "I feel. . ." and then asking how he or she thinks the protagonist feels. In the beginning the facilitator may have to do this several times in order to orient the people who are doubling. It also may be important for the facilitator to demonstrate how the doubling is done in an effort to show the chosen double more accurately what to do. However, once this becomes part of the regular routine within the group, the members will usually spontaneously offer "I" statements from the double role.

In an effort to enhance the depth of support in the group, or the range of potential reactions, the facilitator may want to use more than one double with a protagonist. Such a procedure is termed a "multiple double." In this manner the facilitator can invite several people to come into the double role. This allows the protagonist to feel the support and range of reactions in a direct way. The method for using a multiple double would be to have the protagonist sit or stand across from the other protagonist(s), auxiliary(s) or empty chair(s) to reflect the adversarial nature of the role-play. People from the class would then be invited to stand behind the protagonist to say his/her thoughts and feelings about the negotiation about to take place. Once the first class member has spoken they return to their seat and the next group member is invited up and so on.

Each of these statement may be a portion of what the protagonist is feeling. Some may be more accurate than others, some may just be wrong (see the section below on correcting the double) in any case, the array of feelings now explored usually gives the protagonist a feeling of being understood, as well as food for thought. One of the multiple doubles may have said something the protagonist hadn't thought of previously. (E.G. "I wish I had more time to negotiate this contract. I didn't realize how long each phase would take.") The protagonist is able to select from those doubles the one (or two if it will be a paired double) that can be used to further his or her understanding in the situation. Once the double(s) has (have) been chosen you may ask them to continue with the line of thinking they have just brought up. In this way the depth and breath of the situation can be more readily experienced by the protagonist.

Using a multiple double format has the distinct advantage of helping the protagonist's issues understood by the class. It also offers a wide perspective on the issues confronting the person from that culture in that role. Adding action to the training in this way will undoubtedly enhance the attention and interest of the class. In fact the Association for Experiential Education in a forthcoming book , proposes that we remember only 20% of what we hear, 50% of what we read, and 80% of what we do. It will also set the stage for the protagonist to experiment with potential resolutions once the parameters of the negotiation have been identified.

If there are opposing thoughts or ideas, the double function may best be served by a pair who will each take obverse perspectives or by a single double that alternates between these perspectives. Again, for clarity this will be referred to in this paper as a "split double" as one-half of the double will be devoted exclusively to cultural issues. While it may seem contraindicated to have doubles verbalize internal conflict, it can be both supportive and insightful for the protagonist to experience her struggle as understood by her peers.

If the double is being played by a pair, it is best to have one person behind the protagonist to the left and one to the right. Often a member of the group will play one half the pair, and the facilitator or trained auxiliary can play the other half. However, two group members can also do this quite effectively. In portraying the inner struggle of the protagonist the split double will have one voice express culturally relevant information, while the other voice can be conflicting cultural information or emotive reactions.

As an example, suppose you are the primary protagonist this is your first negotiation with a Japanese firm. You decide to begin the negotiation session with a joke. It is a time tested classic back in the states and you figure it to start the session off with the right attitude. You tell it and there is almost no response, a polite smile from one or two of their negotiating team. If you imagine two people representing the split double they might react in the following way:

THE PRIMARY PROTAGONIST
^ (Sits here and faces this way.)^
SPLIT DOUBLE
(in this case two people)
STANDING BEHIND THE PRIMARY PROTAGONIST
^(also facing this way)^

CULTURAL DOUBLE

- These people are so uptight! I can't believe they didn't laugh at that joke. They seem so repressed with their feelings. I can't read them like I can others.

OTHER DOUBLE

- Now what am I going to do? If they didn't like that maybe they won't like the rest of what I have prepared. I was more sure of that joke than I was about our initial offer. What am I going to do now? Maybe I should change my strategy.

You can have the protagonist play his or her own double as a way of showing the class how he feels or what he is thinking. This is particularly helpful if the protagonist can't seem to choose a double and there are no volunteers. If the protagonist is acting as his own double, you can ask him to reverse roles with the space behind his chair. In the role of his own double, the protagonist may make statements about his thoughts and feelings which the facilitator can then ask him to amplify, restate, or alter in some way to enhance it's clarity. This does not preclude other forms of doubling. You may still wish to do a single, multiple or split double after the protagonist has acted as his own double. The value of this comes from the clarification, awareness, and acknowledgment that often happens from playing this role. As an added benefit, it provides a prescriptive role for others in the group to more deeply understand the protagonist when they double for him.

There are two ways a double can be corrected. First, the person playing the double can adjust previously made statements once it is realized that they do not match the internal state of the protagonist. Or, the protagonist may reverse roles with the double to clarify the statements being made. Either way is acceptable. As facilitator, when a double says something to the protagonist the facilitator must check it out. Saying something to the protagonist like "Does that sound right to you?" gives him or her the chance to clarify what was said. If the double has made an error he or she may correct it by trying again with a modified statement. Let's return to the joke teller. Suppose the other double said something like this:

OTHER DOUBLE

- This really makes me angry. I can't believe they don't even laugh out of respect for me coming all the way out to meet them. If they want to play hardball- I'll play hardball!

Lets say this misses the mark completely. The protagonist can't relate to it or it may be too strong. The protagonist would then have the chance to reverse roles with the other double and say something like this:

OTHER DOUBLE (As played by protagonist)

- I'm disappointed . Maybe I need to rethink how I approach these people. I'm not on my usual playing field and maybe I need to spend more time learning the rules.

This correction by the protagonist gives the person playing the other double a chance to clarify their statements in order to align themselves with the protagonists thinking. It also serves to alert others in the group (if you are doing a multiple double) the more accurate thought process of the protagonist. However what is equally important in this process is the fact that the protagonist may have clarified their own thinking in doing the correction. Thus this process works on a couple of levels:

- It corrects the person playing the double.
- It serves to inform others in the class the more accurate scope of the doubling.
- It clarifies the protagonist's own thinking.

If the protagonist is in agreement then we can just move on. If not, and a modification is not forthcoming, I would ask the protagonist to reverse roles with the person playing the double and correct the statement. This would serve as a role prescription for the person playing the double. You would then ask them to reverse roles (back to original positions) and the double would now repeat what the protagonist said . This will insure that the thoughts and/ or feelings will be on target since the protagonist himself or herself identified them during the role reversal. In this way the protagonist is teaching others in the group what he or she is feeling, and group members (doubles) will then be more to accurately indicate the mind of the protagonist. Sometimes it is necessary for the protagonist to repeat the process. Doing the role reversal with the double significantly enhances the clarity of the protagonists thinking. It is important to remember that the people who are playing the double position will use projection to try and place themselves into that role. In doing this they run the risk of not accurately understanding the protagonist's feelings and simply revealing (although not knowingly) their own. Correction through the role reversal is the way to identify more precisely with the protagonist's intentions.

The process and techniques used in doubling include:

- speaking the unspoken (what the person needs to say but is not saying),
- exaggerating,
- minimizing,
- introducing alternatives,
- restating,
- amplifying (highlighting the key part of the statement),
- verbalizing the resistance (why the person doesn't want to say something),
- introducing paradoxes (as would be done with a split double), and
- Clarifying (see the section above on correcting the double).

The cultural double differs in three important ways:

First the cultural double incorporates the more generic purposes of doubling but is limited in scope to the cultural perspective. This is to say that the cultural double may be supportive, expressive, or reorganizing of perceptions--but that these perspectives are to emanate from the cultural being portrayed (from an auxiliary or secondary protagonist) or the reaction to the culturally bound behavior of others (as would be the case with the primary protagonist).

Secondly, The reaction of the cultural double can be either a collective or individual reaction. The cultural double in this regard serves as a value laden perspective that may be challenged by the range of individual motivation. The collective is the enculturated reaction expressed by the individual. The individual reaction is more personal. The cultural double would react as the collective voice of the cultures sense of indignation being expressed through the individual, whereas the individual reaction has been personalized. There is no difference in the impact either of these expressions make. It is merely a difference in how the cultural double can be expressed.

To illustrate this difference let me use a situation offered by Trompenaars and Hampden-Turner (Pg. 200) They tell of an American CEO aware of the Japanese custom of laying business cards (*meishi)* in the same pattern in front of him as the seating pattern for the Japanese delegation. He did this (it serves as an easy reminder of names) but grew bored and impatient with the evasive answers he received. He absentmindedly picked up one of the business cards, rolled it up, and started cleaning his nails with it. When he looked back up the Japanese team were horrified. The card he was using was the Japanese president's(!) The president stood and left the room and the interpreter called an intermission.

What would the cultural double of the Japanese president say? He may have a collective reaction, an individual reaction, or both. Here are some possible choices:

CULTURAL DOUBLE
(Collective reaction)

- I am offended by the way you Americans are so arrogant! You aren't interested in listening to our ideas, you only want to express your own. You are preoccupied when we speak. You are not interested in building a relationship with us.

CULTURAL DOUBLE
(Individual Reaction)

- I am offended personally by your behavior. I am insulted because of the way you have disrespected me. Doing that with my card was a deliberate attack. I won't stand for it.

The third way a cultural double differs from the traditional double is that the person being doubled does not have to repeat what is being said by the cultural double. Traditionally the double speaks and the protagonist repeats what the double says if it is true to his or her thoughts and feelings. The cultural double may be being used for instructive purposes and may not need to be repeated. It is only when a cultural double is expressed and there is certain disagreement with the protagonist that the protagonist should feel compelled to speak and correct what was said.

Let us now return to the seven domains identified earlier by Trompenaars and Hampden-Turner and to provide an example. Limitation in space will prevent all but he first dimension to be explored:

- Universalism Vs Particularism (Rules Vs Relationships)

The Universalist position presents rational arguments and wants to get down to business. The are usually legalistic and bound by the terms of the deal. The particularist sees the relationship at the core of the deal and does business with the intention of having the relationship evolve. For them there is no one right or wrong. Rather there are many different ways of looking at the problem and they see themselves as being flexible on the terms of a deal. Below is a synopsis of the two styles. (This table has been adapted from the text by the above authors.)

UNIVERSALIST

- Focus is on rules not relationships.
- Legal contracts readily drawn up.
- You are trustworthy if you honor your word or contract.
- There is only one truth, the one agreed to.

PARTICULARIST

- Focus on relationships rather than rules.
- Legal contracts readily modified.
- A trustworthy person is one who honors mutual need for changes.
- There are multiple possibilities, each relevant to the different participants.

- A deal is a deal.
- Relationships evolve.

The dilemma under this domain is as follows: Mr. Teok is a second generation American-Chinese employee of a New Jersey pharmaceutical firm based in Tokyo. His goal was to get a joint venture with the largest pharmaceutical firm in Japan. He negotiated for *four* years and the contracts were ready to be signed. He was sent the contract from New Jersey and was extremely distraught when he saw it. It was *several inches* thick. Because of the complexity of the deal the legal department said the contracts were necessary. A 'letter of intent' would not do it. His career was in jeopardy. If he insists on the Japanese signing the contract they would see it as proof that little trust had been developed over the four years. It could cost him the deal. If he tried to go with a 'letter of intent' the legal department would be up in arms and not satisfied.

There are different ways of setting this up as a role-play using a cultural double. The following is one way it might be done:

1. Use an empty chair to represent Mr. Teok as the primary protagonist.
2. Across from this chair set another empty chair for the Japanese CEO.
3. Begin with multiple doubling for Mr. Teok. Different class members would take turns. Some of these responses might sound like this (Cultural and other doubling might be mixed when you begin with a multiple double. This does not matter. From the content will be easy to discern which is which.)

MULTIPLE DOUBLE

(Each phrase spoken by a different student standing behind the empty chair for Mr. Teok.)

- This is terrible. I've been working for four years with one purpose. Now this. I don't know what to do.
- They just don't understand back in New Jersey. If I do this, If I present this contract it's like a slap in the face. It has taken me all this time to get to this point and the Japanese CEO will just think that I never really trusted him.
- I have to make this deal work or I'm through. Back in New Jersey they don't care about anything other than the bottom line. If I don't get him to sign the contract they wont give me any responsibility.
- I don't even want to show the contract to the CEO.
- I feel betrayed by Headquarters. They sent me here to do the job because of my background and experience. Then, when it comes time to close the deal, they dump this on me.
- How can I make this work? I've invested four years of my life on this project and I know what everybody needs what can I do to bring this together?

4. Following this I would assign a cultural double for the Japanese CEO. This double would be used to test out the reactions from Mr. Teok's experimentation.

5. Now that this has been set I would ask a member of the class to take the role of Mr. Teok and experiment with different solutions. As this student takes the role I would as him or her to chose someone to play their double. They could chose a single double, someone to play a split

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double or two people to play the split double. For the sake of example lets say they chose two people to play a split double. The set up would be as follows:

CULTURAL DOUBLE STANDING BEHIND
EMPTY CHAIR OF JAPANESE CEO
\|/ (Facing this way.) \|/

^(Facing this way.) ^
STUDENT SEATED IN THE ROLE OF MR. TEOK
(Two people playing split double standing behind.)
CULTURAL DOUBLE / OTHER DOUBLE

6. The student in Mr. Teok's role would begin by trying out different ideas. He might try this:

MR. TEOK

I'm sorry about the size of the contract. You know how lawyers are. Please take all the time you need to review it.

MR. TEOK's
SPLIT DOUBLE

CULTURAL DOUBLE /	**OTHER DOUBLE**
• I know he isn't going to like this. But I am stuck. He doesn't understand what I'm up against in the USA. We have dozens of lawyers putting these types of contracts together. This is how we do business.	• I 'm nervous about presenting this way. I hope he understands. I don't have any options.

7. This would be followed by having the cultural double behind the Japanese CEO speak in reaction to Mr. Teok's remarks.

CULTURAL DOUBLE STANDING BEHIND

EMPTY CHAIR OF JAPANESE CEO

What is this! For four years we have worked together and I thought I could trust you! This is insulting to me. I thought we had the principles of this deal worked out. How can you do this? I have invited you into my home. We have spent much time together. You know my family and I know yours. How come this is being put in front of me at this time? I'll have to think about this. I certainly not ready to sign it. and I have second thoughts about the contract all together.

8. At this point I would reverse roles with Mr. Teok and the Cultural double for the Japanese CEO. This would allow the student in Mr. Teok's role to experience the cultural double of the Japanese CEO. I might then have him start with the last statement the cultural double said:

THE STUDENT AS MR. TEOK NOW IN THE ROLE OF THE CULTURAL DOUBLE STANDING BEHIND EMPTY CHAIR OF JAPANESE CEO

... I certainly not ready to sign it. and I have second thoughts about the contract all together. I really feel put off by this. I wish you didn't dump this on me like this. This doesn't feel right. It is too much of a surprise.

9. The student formerly playing the cultural double for the Japanese CEO is now sitting in Mr. Teok's chair. Since the function of this role is to help the primary protagonist (the student originally playing Mr. Teok) They might ask a spontaneous question.

STUDENT FORMERLY PLAYING THE CULTURAL DOUBLE FOR THE JAPANESE CEO NOW SITTING IN MR. TEOK's CHAIR

What would I have to do to somehow make this more presentable? I certainly don't want to offend you but I have a problem and I don't know what to do about it.

10. Now the primary protagonist would have a chance to think this through in the other person's position.

THE STUDENT AS MR. TEOK NOW IN THE ROLE OF THE CULTURAL DOUBLE STANDING BEHIND EMPTY CHAIR OF JAPANESE CEO

I think I would appreciate it if you told me what the problem was. Since we have mutual respect for one another I would see your dilemma as one we could work on together. I would have appreciated it if you acknowledged our relationship first by doing this. This would let me know that you value what we have developed with each other rather than some contract.

11. At this point I would reverse roles and have the two back into their original positions. The primary protagonist is back in the chair as Mr. Teok and would now try again.

MR. TEOK

Our American headquarters have sent me a rather extensive contract concerning our mutual interests. In America this is standard practice but I don't want to insult you by bringing it to you. I would like to hear your thoughts on how we might proceed.

MR. TEOK's
SPLIT DOUBLE

CULTURAL DOUBLE /	OTHER DOUBLE
• My company has sent me here to make this work. I do know both sides of the coin and don't want to force the situation. I would rather it take a longer time and the relationship is preserved than to try and push it and blow the whole thing.	• This feels better. I am sharing the dilemma. Instead of Me Vs. Him we have joined forces to mutually deal with the problem. This feels more constructive.

12. Depending on the nature of the exercise. This might be a place to stop and return to the class discussion to analyze what done.

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In a summary fashion the analysis by the class might come up with the following guidelines:

UNIVERSALISTS (for particularists)

- Be prepared for logical rational arguments designed to persuade you to their way of thinking.
- They are not being rude when they want to "get down to business" it is just their way.
- Consult with a lawyer concerning the legal implications of your contract.

PARTICULARISTS (for universalists)

- Be prepared for personal stories unrelated to the topic.
- Small talk is their way of getting to know you. To know you better is the link in doing business with you.
- Consider the personal impact of your contract (as in the above example).

This sample serves to demonstrate the use of various action methods to enhance the understanding of different cultures through the use of practical dilemmas. These methods allow for involvement, experimentation, observation, insight, confrontation of sterotypes, conflict resolution, empathy, reconsideration, self reflection, and interest. The facilitator of these methods shifts the presentation of the material to an experiential level for the students. Indeed I believe it is in this fashion that diversity may be truly appreciated, and the greater goal of making "both values work together" be achieved.

While these examples are drawn from the world of business the idea, of course, is for teachers to use these experiential action methods within their own disciplines with the goal of increasing awareness of different ethnic, social, racial, religious, and other cultural factors.

I would like to bring the paper to a close with a quote from my own discipline (the Segall, Lonner, & Berry article mentioned earlier ,1998) which I found to be inspirational.

> "...cross-cultural psychology will be shown to have been successful when it disappears. For when the whole field of psychology becomes truly international and genuinely intercultural--in other words, when it becomes truly a science of human behavior--cross-cultural psychology will have achieved its aims and become redundant." (Pg. 1108)

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